PROBLEMS IN ARCHITECTURAL DRAWING

F · G · ELWOOD

Bonita Sutton
Room 4.

PROBLEMS IN

Architectural Drawing

A TEXT-BOOK AND PROBLEM BOOK
FOR BEGINNERS

BY

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THE MANUAL ARTS PRESS
PEORIA, ILLINOIS

Printed in the United States of America

PREFACE

THE purpose of this book is to provide a suitable working text for beginners in architectural drawing. Altho it is intended primarily for the use of the student, wherever elementary architectural drawing and construction may be taught, it will be found to be of great value to the beginning draftsman in architectural offices, as well as to the artisan, foreman, or contractor, in the building trades, who may wish to make his own drawings.

The preparation for working out the problems should consist of preliminary work in elementary mechanical drawing, including the use of the instruments, simple geometric construction, and orthographic projection.

The book presents two main divisions. The first part consists of five chapters of text, containing illustrations and explanations of the best methods employed in architectural drafting and construction. It contains information on typical wood and masonry construction; also tables of designing data, such as have been found to be of constant value in practical work.

The second division is made up of groups of problems progressively arranged, from which the teacher may select those best adapted to the needs of the pupil.

All of the problems are practical, buildable projects, involving standard forms of construction. Those of the first group may be worked out in a correlating carpentry class. They are the result of both teaching and practical experience, and are presented in a form which the author has found to be successful, and which requires effort and thought on the part of the student—not merely copy work.

In elementary problems the principles of design may be as effectively applied as in larger projects, without sacrificing the vital structural principles involved. This, and the practicality of each project has been kept constantly in mind both in selecting and outlining of the problems.

The architectural field is so broad and varied in its many phases that to cover all of its various divisions in one volume is an impossible task. For this reason this book does not cover the subjects of architectural perspective, shades and shadows, architectural rendering, or the orders of architecture. These may be more properly considered in an advanced course.

FRANKLIN G. ELWOOD.

June, 1924

ACKNOWLEDGMENTS

Grateful acknowledgment is made to my parents whose self-sacrifice made possible the education upon which this book is based, and whose memory is a constant source of inspiration.

Acknowledgment is also made of the assistance derived from various architectural magazines and books on architecture and kindred subjects.

Appreciation is hereby expressed to Mrs. M. L. Fuller of Peoria for her criticism and helpful suggestions on garden design; also to Charles A. Bennett for his kindly interest, encouragement and suggestions in the preparation of this book.

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LIST OF TEXT ILLUSTRATIONS

TO THE TEACHER

IN TEACHING architectural drawing it is necessary not only to teach the student the conventions and methods of making a drawing, so that he will be able to make a neat, good-looking plan or elevation, but it is also vitally important to give him a knowledge of the underlying construction back of the plan and elevation. Therefore, the student should study carefully articles on new features whenever presented, noting the illustrations pertaining to them. The information given in this text may be supplemented by references to standard books on carpentry and masonry construction; and written papers may be required. The teacher should, before presenting or assigning a problem to the class, give a short talk on that particular phase of the work, illustrating by blackboard sketches in perspective or isometric, or by small scale models. Note-book work is also valuable. The student may make measurements and sketches of work under construction, also of doors and windows, fire-places, mantels, stairs, height of riser and width of tread. This data may then be brought to class for use and discussion.

Full-scale models of windows and other details are apt to prove too cumbersome for the average drafting room where space is at a premium. Small-scale models and sections of the various standard mouldings and pieces of lumber may be obtained and mounted upon wallboard panels, which may then be hung on the walls of the drafting room. These will prove very valuable. On request many excellent and worth-while samples of building materials will be sent by manufacturers. Above all, reference material in the shape of a few standard books on building construction and design, current magazines and manufacturers' literature should be kept on file, available for the student.

In an advanced architectural course a certain amount of freehand drawing should be included, accompanied by a study of the history of architecture and the fine arts. A series of slides may be obtained of the best examples of both modern and classic architecture, and thru the use of these, the coming generation may be brought to a better appreciation of good design, the lack of which is woefully evident in our typical domestic architecture of recent years.

Starting with Group 1, the problems are arranged somewhat in the order of their difficulty, the methods of presentation varying also, according to the individual problem and its group. It is not necessary to draw all of the problems in any one group. The instructor may select

those best suited to the student or those in which he will be most interested. It must be borne in mind that the types of construction illustrated are not the only methods by which the structure may be evolved. There may be other ways equally good. Methods vary according to the locality, depending upon availability of building materials, climatic conditions and numerous other factors. Therefore, the instructor may, in some cases, change the type of construction to correspond to prevailing local practice.

In drawing any problem the student should first study carefully the specifications and requirements for it, and when reference is made to an article or to a figure in the text, he should look it up, as it may explain a principle encountered in that particular problem.

The perspective sketch which accompanies the statement of the problem helps the student to visualize the completed building, while the details furnish all the smaller dimensions, as well as show just how the parts are put together.

The teacher may use his own judgment in having the details drawn. They may in some cases be advantageously shown in an accompanying plate either at the scale suggested or even larger. A good task to call forth the ingenuity of the student is to require the placing of the parts so as to form a well-balanced sheet. (Plate 15.)

CHAPTER I

Architectural Drafting

1. Definitions. Architectural drafting is a language, a medium of expression. It conveys to the owner and to the builder the ideas and thoughts of the architect. Because of the necessarily small scale to which the drawings are made, the language of the draftsman, in most cases, is more symbolic than literal. The principal divisions of this symbolic language are plans, elevations, sections, details and perspectives. The *plan* is a horizontal section or cut thru the building, usually taken just above the window sills. (Fig. 1.) If we imagine the portion above this cut removed, we shall, by looking directly or vertically downwards upon the remaining part, see the plan.

The *elevation,* which corresponds to the front view in mechanical drawing, is a vertical projection of one face of the building; that is, if we could view that face of the building from directly in front of every point on its surface, we would see its elevation. (Fig. 2.)

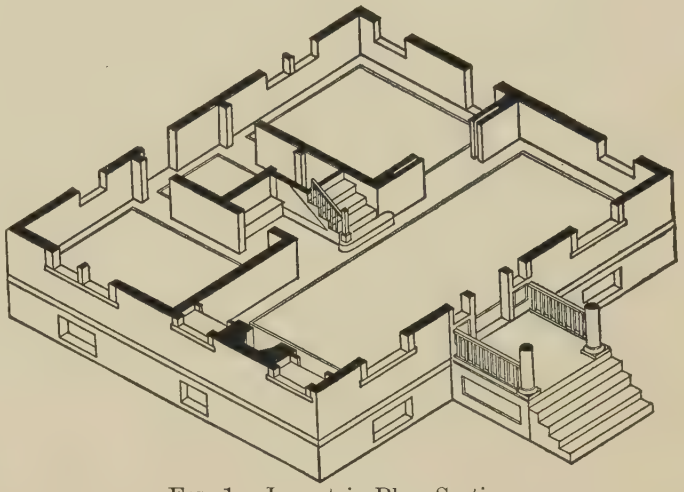


Fig. 1. Isometric Plan Section

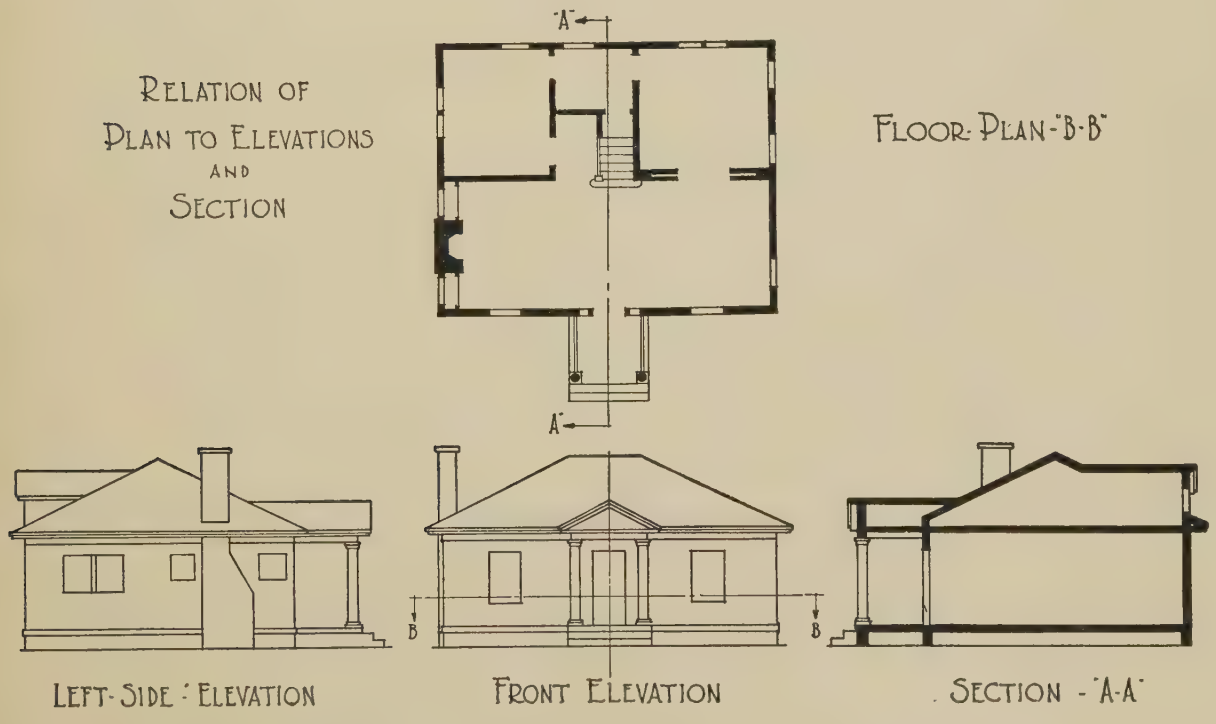


Fig. 2

The *section* is a vertical cut thru a building, usually along the line of one of the main axii. If we conceive one of the pieces removed, we shall, by looking horizontally at the remaining part, see the section. (Fig. 2.)

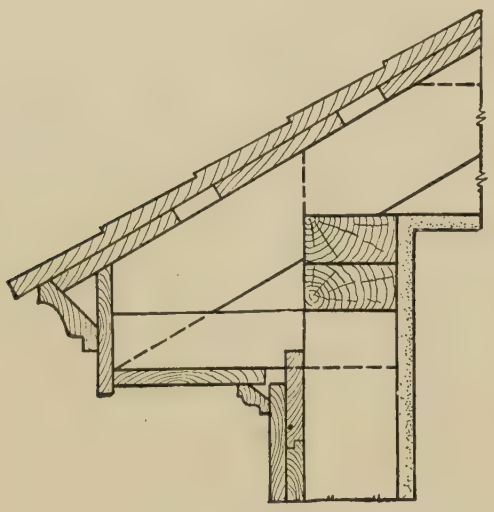


Fig. 3. Detail

A *detail* is usually an actual representation of a part of the building drawn at a large scale, showing clearly dimensions and such small parts as are not shown on the small scale plan and elevation. (Fig. 3.)

A *perspective* is a picture of a building as viewed from one point. It is as near an actual representation of the structure, as it will appear to the eye when completed, as it is possible to make. It is employed in preliminary drawings to show to the client how the proposed building will appear. (Fig. 4.)

2. Scope of Architecture. The field or scope of architecture is as broad and varied as the activities and life of man. All architecture may be classified in three general groups; namely, domestic, commercial or industrial, and monumental.

Under *domestic architecture* we find that type of structure used primarily to shelter the family and provide a home. In character, domestic architecture varies widely, the chief determining factor being climate.

In the *commercial* or *industrial* group may be placed practically all buildings, which house the activities of man, such as factories and business buildings of all kinds.

Monumental buildings are those which are related to and serve the religious, social and civic life of a people. Churches, temples, art museums, libraries, courthouses, city halls,

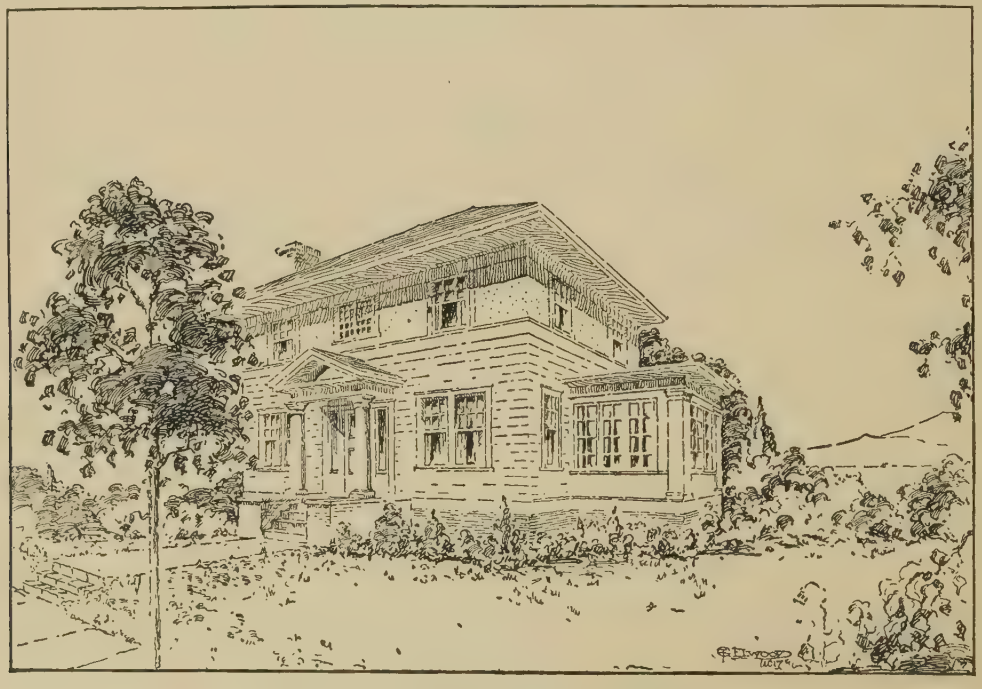


Fig. 4. A Perspective of a House

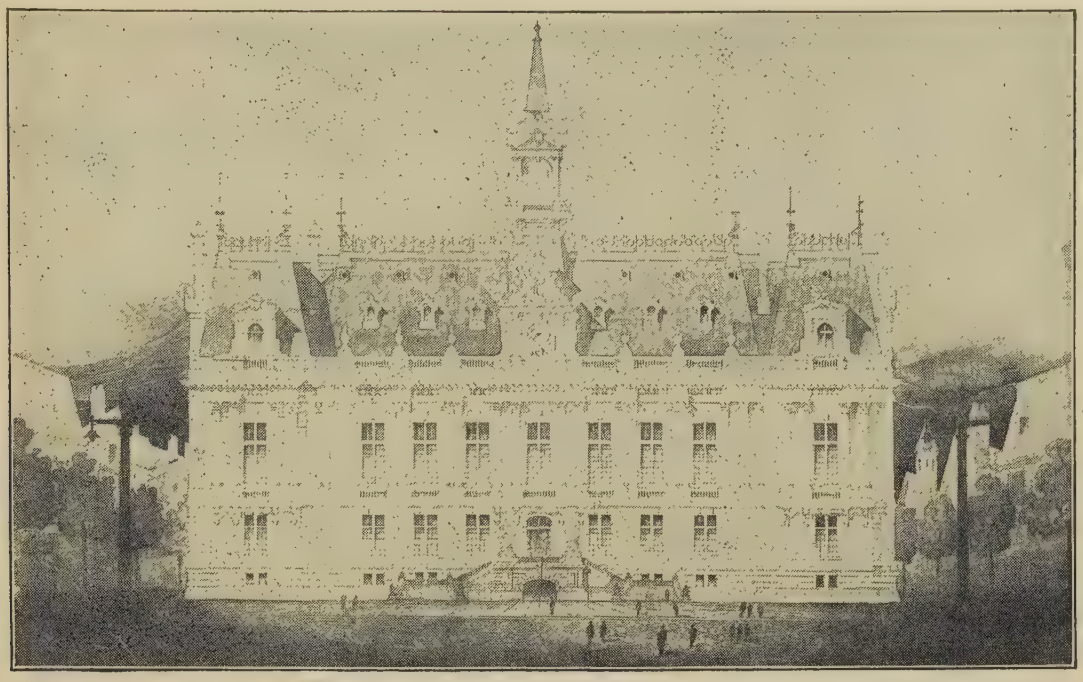


FIG. 5. Design for a City Hall

etc., are examples belonging to this group. It is in this type of building that architecture reaches its greatest height, as the Parthenon, the Taj Mahal, the great cathedrals of the Middle Ages and our own Lincoln Memorial, bear witness. (Fig. 5.)

The architect serves in all of these great divisions of architecture, interpreting the life and ideals of the people; and with the cooperation of the builder, translates that interpretation into structures of wood, stone and concrete.

3. Method of Procedure. Before any work is done on the drawings, the architect or draftsman first secures all definite information pertaining to the proposed building. The conditions usually involve the question of location or site and its size, the architectural style to be employed, the cost limit, the kind of finish and interior decoration, heating, lighting and any special or individual requirements.

The second step is a series of single line *sketches* indicating the arrangement and approximate sizes of rooms with the location of door-and-window openings. The elevations are also roughly sketched, indicating the style of architecture to be employed. Freehand perspectives of the building or portions of it from various viewpoints are

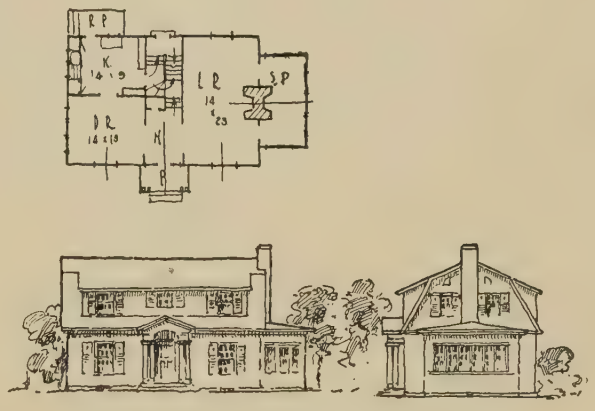


FIG. 6. Sketch Plan and Elevations of a House

made when the client cannot visualize it from the plan and elevations. These sketches are made with a soft pencil, and, with the aid of shadows and a background of trees and shrubs, appear very realistic. (Fig. 6.)

The third step consists of *preliminary or competitive drawings,* which are usually made

by the architect before proceeding with the working drawings. Especially in competitions for large public works, it is necessary to submit sketch presentation drawings, which should not be confused with the working drawings.

The architect, in the case of residence work, makes scale sketches of the floor plans and elevations at the regular ¼ inch-to-the-foot size or at the smaller scales of ⅛ or $\frac{1}{16}$ inch to the foot. These drawings show the room arrangement, the thickness of walls and partitions, location of door-and-window openings, all fixtures and built-in equipment and all main dimensions. The walls in plan are blacked or shown in poché and often the position of furniture is indicated to give scale to the rooms.

In the elevations, shadows and background are rendered in water color or crayon. (Fig. 5.) It is at this particular stage that the success or failure of the design is determined, for the preliminary drawing is the work of the designer, who must have a sense of the proper proportion of masses, fitness of the design for its intended purpose and use of the proper style. This ability may be partially inborn or it may be acquired thru study and observation of good architecture. In studying design, thin tracing paper is used so that a single part may be redrawn and the resulting effect observed without drawing the entire elevation or plan again.

After the preliminary or sketch drawings have been accepted, the *working drawings* are made.

These, accompanied by written *specifications* relating to the materials to be used, their quality and the kind of workmanship required, complete the architect's duties, with the exception of his personal superintendence during the erection of the building.

As a rule a set of working drawings consists of all the floor plans and elevations, a vertical section showing heights and construction, and enough details to show the builder just how the structure is to be made. All drawings should be made accurately to scale, all dimensions clearly shown, and explanatory notes neatly lettered. (Plates of Dutch Colonial House.) The purpose of working drawings is to give complete information of the building to be erected in so far as size and form can be expressed in projection. The scale commonly used is ¼ of an inch to 1 foot, the ⅛ and $\frac{1}{16}$ inch scales being used in larger work. Details are drawn at ½, ¾, 1½, and 3 inches to 1 foot as well as full size.

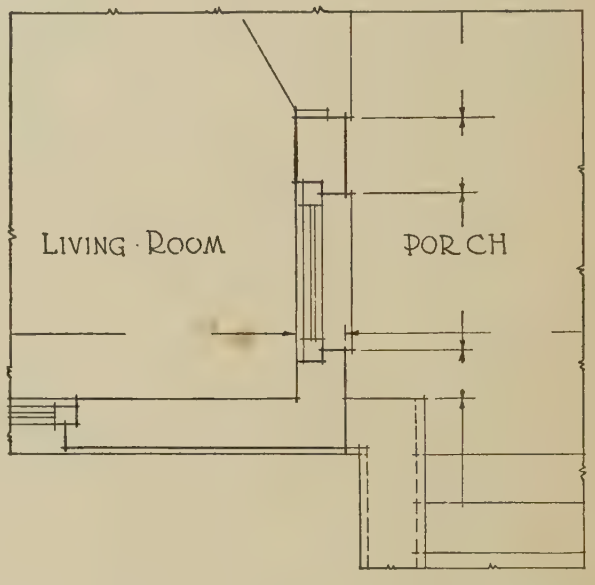


Fig. 7. Example of Architectural Drafting Technic

4. Technic is the kind and quality of lines used in making a drawing; the method of dimensioning; the character of figures and arrow heads employed; the style of the lettering and the general spacing or grouping of titles and notes. Architectural drafting permits a greater freedom in the use of lines than mechanical or machine drawing. In the majority of architectural offices the lines of a drawing are crossed at their junctions. (Fig. 7.) The purpose of this custom is to gain speed; it also gives a more artistic appearance to the drawing. In beginning architectural drafting in school, this method should not be attempted at first, as the transition

from the exactness of mechanical drawing, with its absolute meeting of lines, is too abrupt. The student is apt to overdo the matter and become careless in his work. As he gains more knowledge of his subject and further experience in drafting, he may then adopt the freer style. Again, as he goes from school into the architectural office, he must necessarily adapt his methods to the particular style of that office.

Architectural *lettering* may be divided into two groups; namely, inscription lettering, and lettering used on drawings for notes, specifications, titles, etc. Inscription lettering consists of the use of letters for architectural inscriptions to be carved in wood or stone, or cast in metal, forming an integral part of a design. The standard architectural letter is the Old Roman, whose genesis is found in the ruins of ancient Rome, the best example being that on Trajan's Column. It will be noticed that the strokes of the Old Roman are not uniform in thickness, the sloping strokes from the left downward to the right being the heaviest except in the case of the Z. The type most commonly used in architectural offices for notes and sub-titles is a single line adaptation of the Old Roman letter. A vertical letter is more prevalent, altho some architects prefer the sloping letter of about 67½ degrees pitch. In this type the lines are all kept of a uniform weight and serifs, or small finish marks, are used on the end of the straight-line strokes. The lower case, or small letters, are often employed for notes. (Plate 2.) Much individuality is permissible in architectural lettering. The letters may be compressed, especially the straight line letters, while circular letters like the O, C and Q, should be made full and round. In the composition of words, the lines of the letters and the spaces between the letters should be such as to give an effect of even spacing. This cannot be accomplished, however, by actually spacing letters the same distance apart because of the variety in the forms of the letters. A space the width of the letter M is allowed between words. All figures should be made clearly and distinctly so there will be no mistake in reading the dimensions.

The cross between fractions should be horizontal rather than sloping. Guide lines should always be drawn for the top and bottom of the letters. Notes are usually $\frac{3}{32}''$ or $\frac{1}{8}''$ in height, sub-titles $\frac{3}{16}''$ or $\frac{1}{4}''$, and the size of titles depends much upon the size of the drawing and the space available.

The panel or title strip about $\frac{3}{4}''$ wide at the bottom of the sheet is perhaps the most satisfactory place for the title when a uniform placing of the title is desired. The rectangular title in the lower right-hand corner often cuts into the available drawing space too much. It will be noticed in the accompanying problems that the title is usually balanced either in the center or in the remaining space available. This gives the draftsman more freedom and makes the titles more of a problem in design.

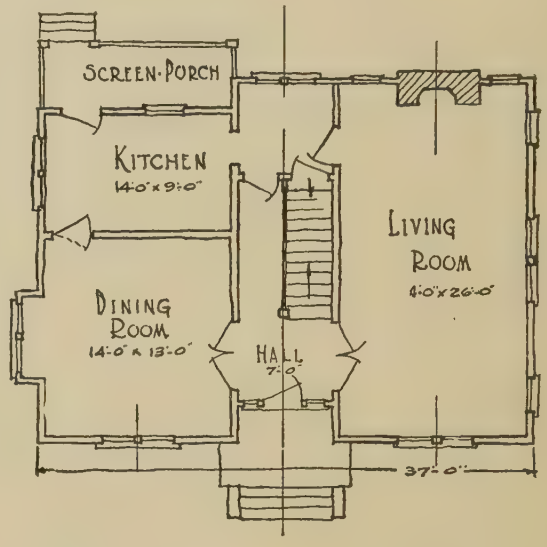
CHAPTER II

Design and Execution

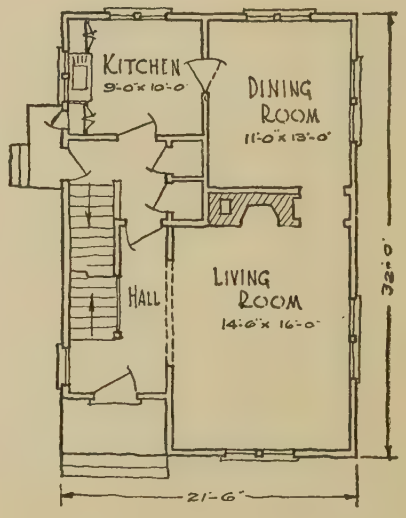
5. Plan Evolution. Since a large percentage of the architecture of any country is domestic, and as we all come in contact with, observe, and are influenced by that type, we shall consider it alone in the elementary course in architectural drawing. Back in the dim and misty dawn of civilization, we find man's first attempt in his struggle upward was to make himself a shelter. The first shelter was doubtless a cave or a hut made from the branches of trees, with the cracks covered with clay or mud. Among the nomadic tribes a tent made of the skins of animals was and is used today in certain sections of the world as a shelter. Remains of prehistoric architecture, constructed of stone and showing a high degree of development in the builders, are found in various countries. Among the most recent and best preserved are those found at Cuzco, Peru. In architecture of historic times we find first the Egyptian, then the Assyrian, Greek, Roman, Byzantine, Romanesque, Saracenic, Gothic, Renaissance and Modern. Up to to eighteenth century the domestic plan was merely a succession of rooms attached one to the other, or a number of rooms built about a hollow square or court. No attempt was made to secure privacy or convenience by means of hallways. It is only at a comparatively recent date that the modern plan with its economy of space and its efficient arrangement has come into use.

6. Basic Types. Modern house plans, when analyzed, may be divided broadly into two groups, depending upon the location of the entrance and entrance hall. These two basic types are the *central hall or entrance type,* and *the side hall or entrance.* Variations of these types will be found, but it will always be observed, on study, that they may be reduced to one or the other of the above divisions. (Fig. 8.)

7. Determining Factors. The most important determining factor in the character of the plan is *climate.* For example, a house adapted to a Southern climate differs con-



CENTRAL · HALL · OR · FORMAL · TYPE
ADAPTED · TO · A · BROAD · LOT.



SIDE · HALL · TYPE
ADAPTED · TO · NARROW LOT.

Fig. 8. Basic Types of House Plan

siderably from one best suited for the North. For the Southern climate the house is usually one story or a story and a half. There is no basement or heating plant; fire-places, one for each room, being employed. The windows and doorways should be large to allow a free circulation of air at all times. Broad projecting cornices and large open porches help keep the house walls cool in summer time. The windows are also equipped with blinds or shutters.

On the other hand, the Northern house should be more compact, so that it may be easily heated; and the entire basement should be excavated. The projection of the cornices need not be so great, and porches should not be so numerous or deep as to shut out the light from the rooms.

8. Site and Orientation. The character of the *site* influences the plan and design of the house. A side hill site will demand a design to conform to the slope of the land. A level site, on the other hand, will not demand so much consideration. Trees, pleasing vistas and the location and character of neighboring buildings will all influence the plan, and therefore should be carefully studied. *Orientation,* or the way in which the house is to be placed with respect to the cardinal points of the compass, is an important determining factor of the plan. Facing the house to the southeast will secure the maximum amount of sunlight for all the rooms at all times of the year. Facing south or east, providing the main rooms are in the front, will give satisfactory exposure. If the house must face the north, plan the main bed room and living room on the east or south sides. Also locate the sleeping rooms so that the prevailing night winds in summer time will strike them and thus insure cool bedrooms.

9. Style. In the modern American domestic architecture there are several distinct *styles.* The choice of any particular style is influenced by the locality. The chief styles are the Colonial, English, Mission style of California and the Mid-western or so-called Chicago style. Less prevalent, but popular, are those

TYPICAL - COLONIAL

TYPICAL ENGLISH

ITALIAN INFLUENCE

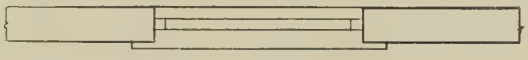
MISSION - TYPE

CHICAGO OR MID-WESTERN TYPE

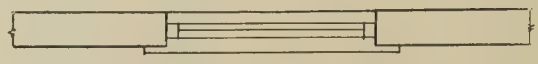
FIG. 9. Typical American Styles of Homes

PLAN - SYMBOLS

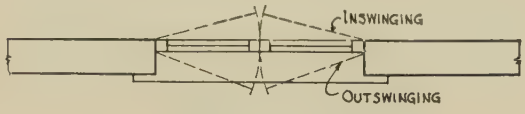
WINDOWS



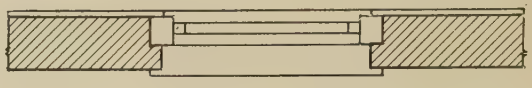
SINGLE SASH IN FRAME



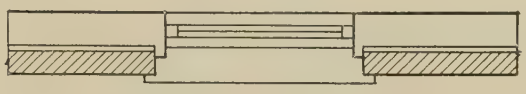
DOUBLE HUNG IN FRAME



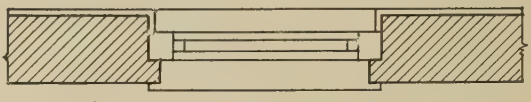
CASEMENT IN FRAME



DOUBLE HUNG IN 9" BRICK WALL

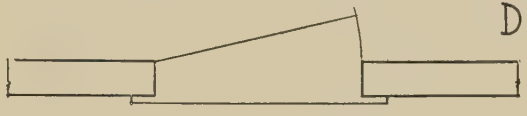


DOUBLE HUNG IN BRICK VENEER



DOUBLE HUNG IN 13" BRICK WALL

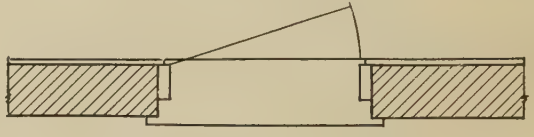
DOORS



OUTSIDE DOOR IN FRAME

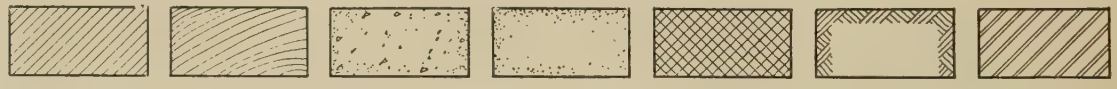
INSIDE DOOR IN FRAME PARTITION

DOUBLE ACTING DOOR IN FRAME



OUTSIDE DOOR IN BRICK WALL

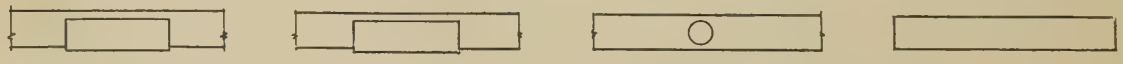
MATERIALS IN PLAN



BRICK WOOD CONCRETE STONE TILE EARTH METAL

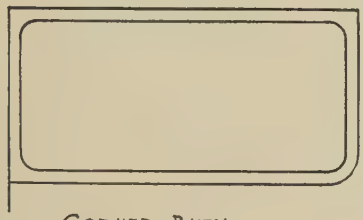
ELECTRIC FIXTURES

CEILING OUTLET — CEILING GAS & ELECTRIC — WALL BRACKET — WALL BRACKET GAS & ELECTRIC — BASE OUTLET — FLOOR OUTLET — DROP CORD — HEAT OR POWER OUTLET



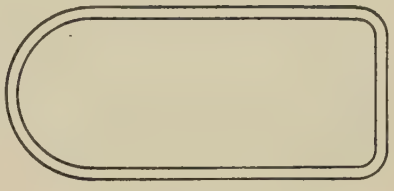
HOT AIR REGISTER FRAME — VENT REGISTER — SOIL PIPE IN FRAME — STEAM OR HOT WATER

PLAN · SYMBOLS · AND LETTERING



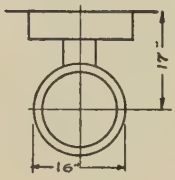
CORNER BATH
2'-6" x 5'-0" & 2'-6" x 5'-6"

LAVATORY
16" x 21" & 20" x 24"



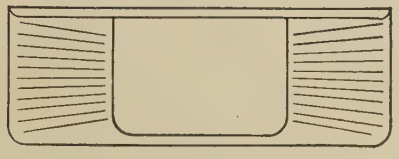
BATH
2'-6" x 5'-0" & 2'-6" x 5'-6"

CORNER LAVATORY
16" x 16" - BOWL 10" x 14"



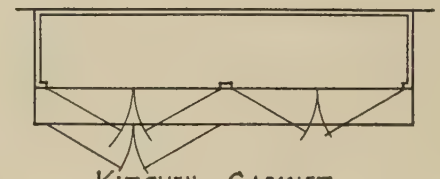
W. C.

LAUNDRY TUBS



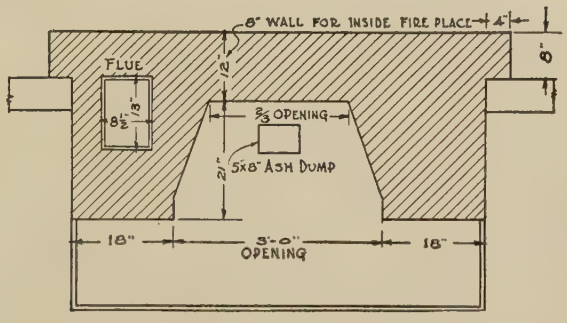
KITCHEN · SINK
SINK 20"x30" OR 20"x36" DRAIN BOARD · 18"x24"

SLOP · SINK
20" x 24"



KITCHEN · CABINET

FIRE-PLACE
SIZE VARIABLE
TO FIT ROOM.



ABBREVIATIONS

℄	CENTER-LINE
O.C.	ON · CENTER
T.C	TERRA COTTA
T&G	TONGUED & GROOVED
W.C.	WATER CLOSET
C.O	CLEAN OUT
W.P.	WHITE PINE.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z &

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z &

a a b c d e f g g h i j k l m n o p q r s t u v w x y z z - 1 2 3 4 5 6 7 8 9 0 .

Small · letters · may · be · used for notes.

which show the Italian or Spanish influence. (Fig. 9.) Of all the styles the *Colonial* is the most purely representative of America. It is the one in which good proportion and simplicity of design are most often found. It is a style that will always be permanent and of which one will never tire. In character it is formal; it is marked by its symmetry, its plain and pleasing proportions and the refinement of its details.

The *English* style is an adaptation of the best in English country houses to the conditions prevailing here. It is characterized by its informal plan, its casement windows, half timber work in the gables, steep roofs with many gables and dormers, and the narrow overhang of the cornice. It is usually of masonry or stucco construction.

The *Mission* style, prevalent on the Western coast, bears the influence of the Old Spanish Missions. It has plain wall surfaces, with small window openings sometimes grouped, plastered or stucco finish and tile roofs.

The *Chicago* style is perhaps the most original type of which we may boast. It is designed with broad horizontal lines to conform with the level landscape of the Middle west. Its chief characteristics are its excessive overhang of cornice and low pitched roofs.

The *Italian Renaissance,* with its arched window and door openings and its balconies with wrought iron balustrades, shows a marked influence in many of the more recent houses. Economic considerations also have much to do with the size and style of the house; the simpler the style and the more compact the plan the less the cost. The materials of construction to be used depend largely upon the proximity of their source and their availability.

10. Plan Description—Symbols. As previously stated, architectural drawing is symbolic rather than literal, especially so in the small scales. Hence, in the plans the draftsman uses certain *symbols* or *conventions* which by common usage are intelligible to all in the building trades. With the exception of the lighting fixtures, these symbols are not standardized, but they are all becoming fairly uniform in the architectural field. For the methods of indicating windows, doors and interior fixtures, see Plates 1 and 2. Notice that the width of a window in a frame wall in plan is from the face of one pulley stile to the face of the other. This is the only important dimension, the exact position of the other lines being immaterial, providing their location is kept uniform throughout the drawing.

11. Walls. Exterior frame walls are usually figured in the ¼″ scale drawing as 6″, which is made up of studs 3⅝″, sheathing ⅞″, siding ¾″, lath and plaster ¾″. Some architects, however, figure 7″, taking nominal sizes for the building material rather than actual sizes. Inside partitions are also made 6″, altho they will actually figure up at less. Closet partitions are often taken as 4″, the studs being placed the narrow way. Brick walls are 9″, 13″, or 17″ with 1″ furring space and ¾″ lath and plaster on the inside. Basement walls of concrete should never be less than 8″ even for small buildings. A 10″ or 12″ width is the average.

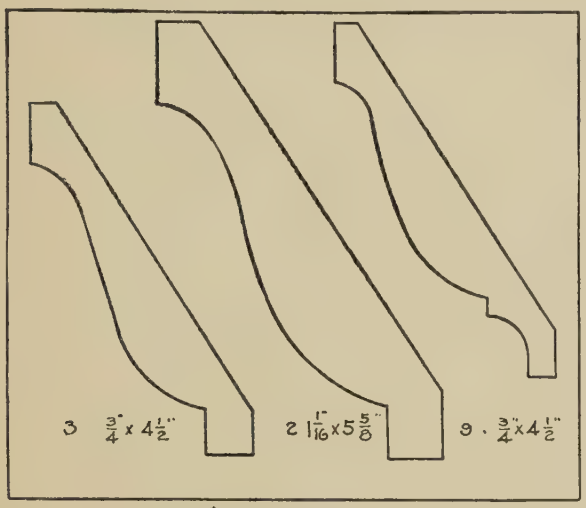
12. Windows. The two types most frequently used are the *double-hung* and the *casement.* Sometimes on smaller drawings the double-hung window is indicated in the same way as the single sash in Plate 1. As stated before, the sash opening is the width indicated in plan, altho the glass size only is given. This is 4″ less than the width of the window in a frame wall as shown on the plan. A 30″ or 32″ glass width might be considered as average for a single double-hung window.

The following tables give typical sizes of windows:

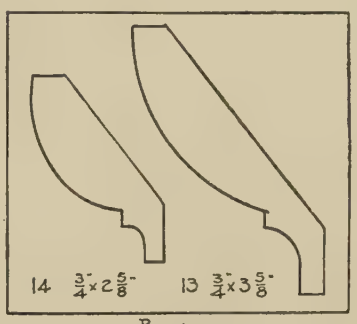
BASEMENT WINDOWS
TWO LIGHTS

Glass Size	*Sash Opening Size*
8″x10″	1′ 9″x1′ 3″
10″x12″	2′ 1″x1′ 5″
12″x14″	2′ 5″x1′ 7″
14″x16″	2′ 9″x1′ 9″

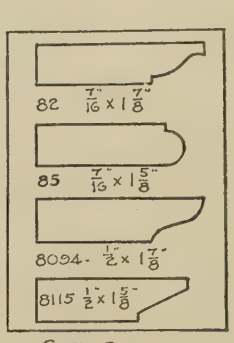
MOULDINGS



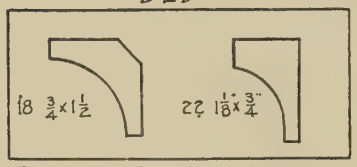
CROWN



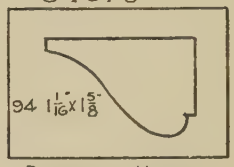
BED



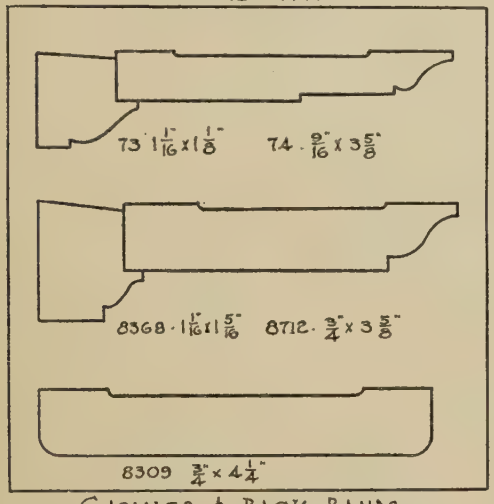
STOPS



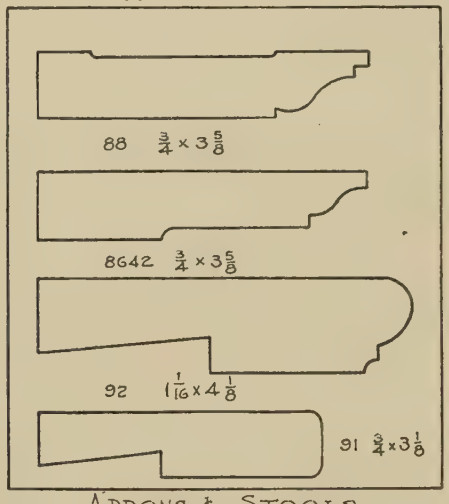
SPRUNG-COVE COVE



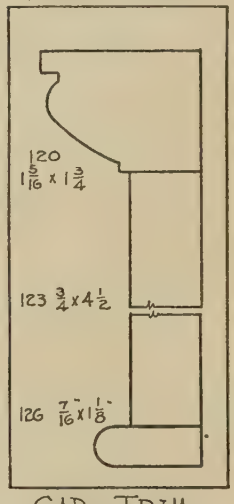
BRICK MOULD



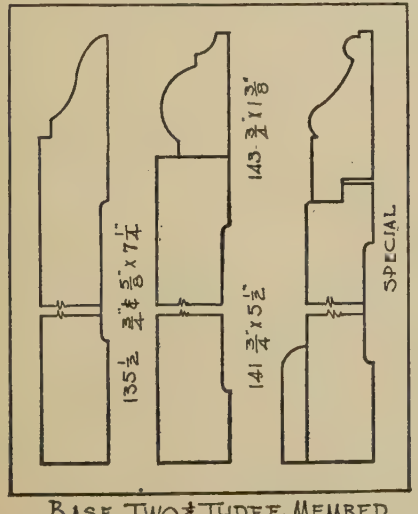
CASINGS & BACK BANDS



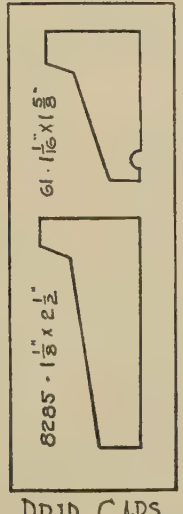
APRONS & STOOLS



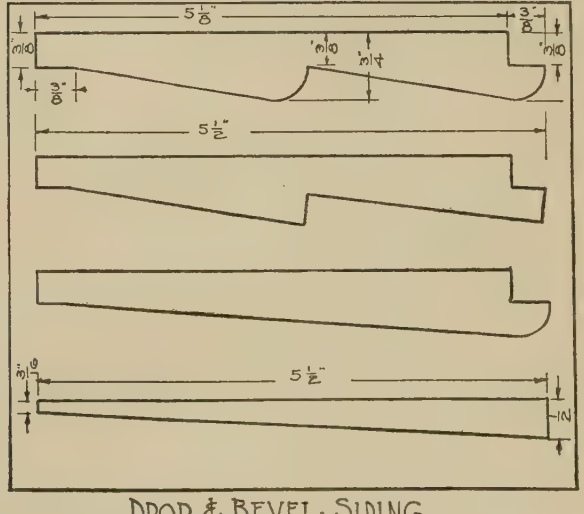
CAP - TRIM



BASE-TWO & THREE MEMBER



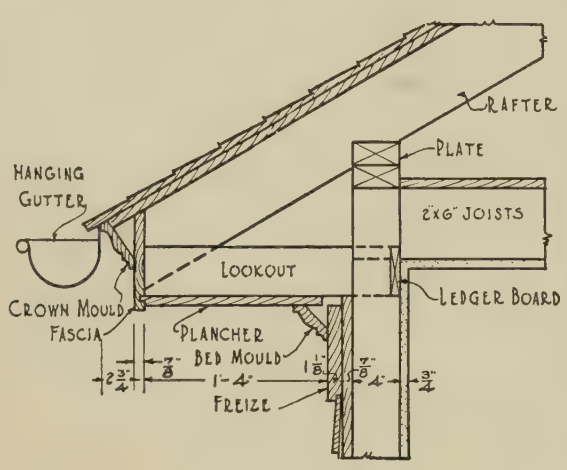
DRIP-CAPS



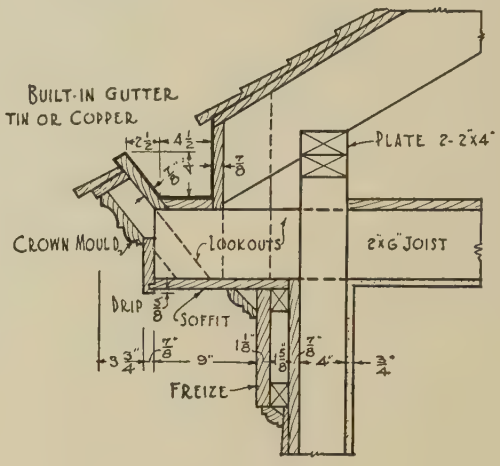
DROP & BEVEL-SIDING

PLATE 3

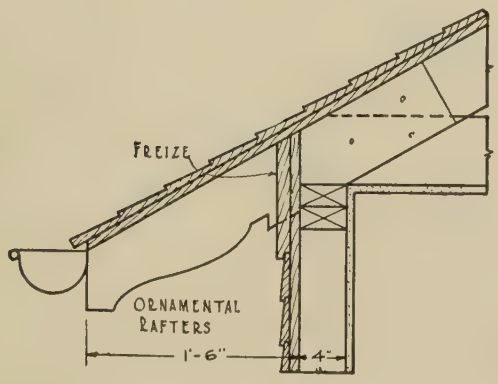
CORNICES



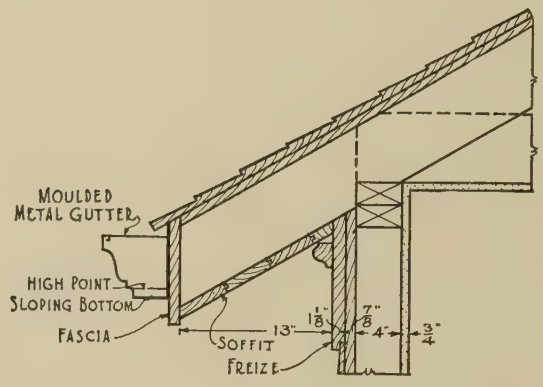
BOX · CORNICE
HANGING GUTTER.



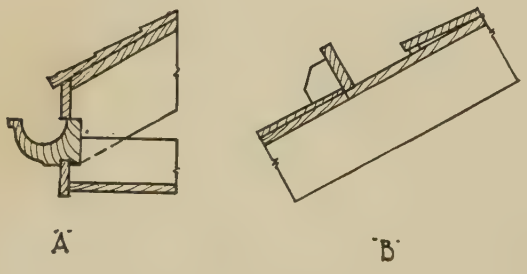
BOX · CORNICE
BUILT-IN GUTTER



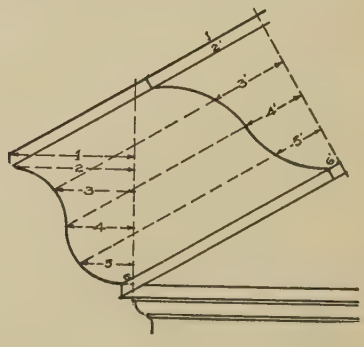
OPEN - CORNICE.
HANGING · GUTTER



BOX - CORNICE
HANGING · GUTTER

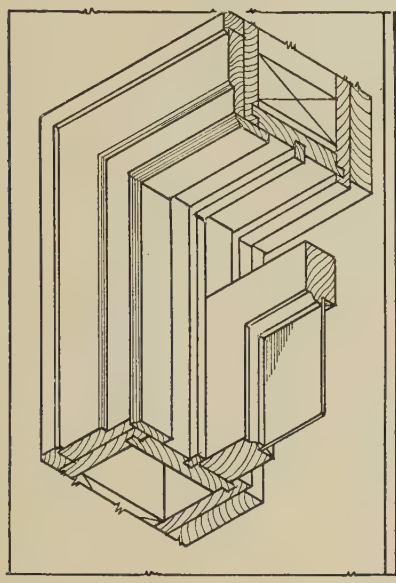


GUTTER · TYPES

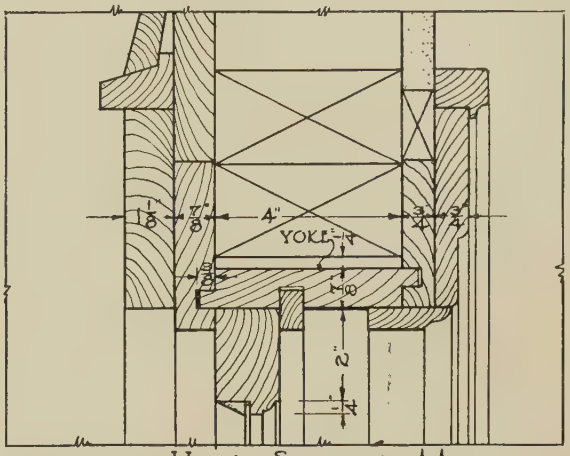


RAKE · MOULDING · FOR · GABLE · OR · PEDIMENT

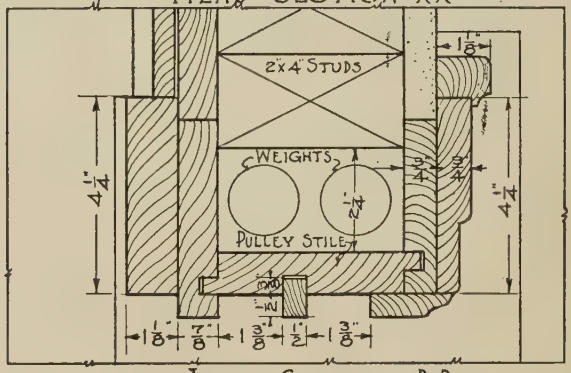
DOUBLE-HUNG · WINDOW



ISOMETRIC VIEW OF HEAD & JAMB SECTIONS

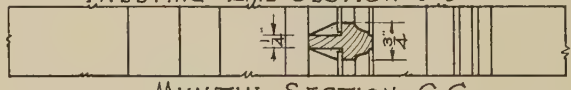


HEAD · SECTION · A-A

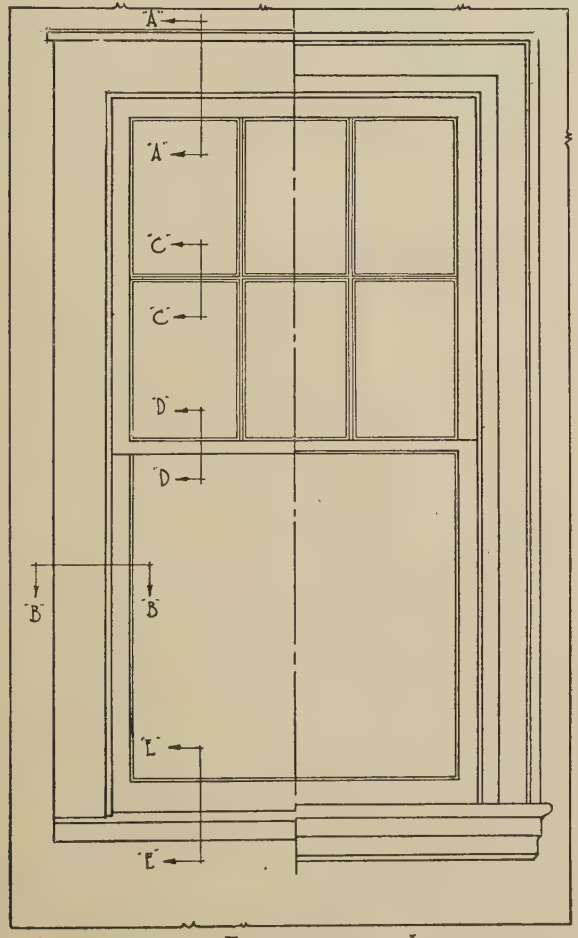


JAMB · SECTION · B-B

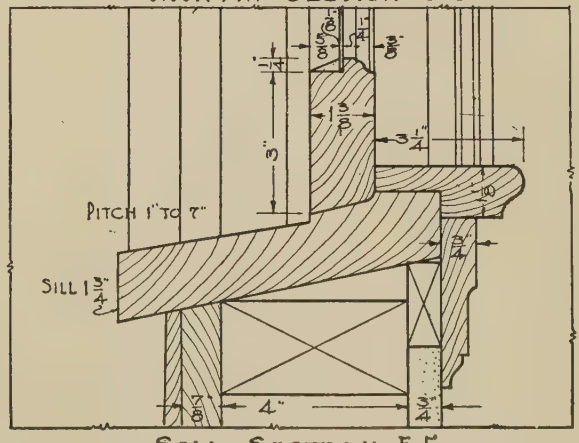
MEETING · RAIL · SECTION · D-D



MUNTIN · SECTION · C-C



EXTERIOR ELEVATION · INTERIOR



SILL · SECTION E-E

THREE LIGHTS

Glass Size	*Sash or Opening Size*
8″x10″	2′ 4″x1′ 3″
9″x12″	2′ 7″x1′ 5″
10″x12″	2′ 10″x1′ 5″
12″x16″	3′ 4″x1′ 9″
14″x16″	3′ 10″x1′ 9″

WINDOW SIZES

Double Hung—Two-light or divided top, check rail. Widths specified first

Glass Size in Inches	*Sash Size or Size of Opening*
20x24	2′ 0″x4′ 6″
24x24	2′ 4″x4′ 6″
24x26	2′ 4″x4′ 10″
26x26	2′ 6″x4′ 10″
28x26	2′ 8″x4′ 10″
28x28	2′ 8″x5′ 2″
30x28	2′ 10″x5′ 2″
30x30	2′ 10″x5′ 6″
32x30	3′ 0″x5′ 6″
32x32	3′ 0″x5′ 10″

CASEMENT WINDOW SIZES

Average size openings for sash in pairs

2′ 8″x2′ 6″	3′ 0″x3′ 0″	3′ 4″x3′ 0″
2′ 8″x3′ 0″	3′ 0″x3′ 6″	3′ 4″x3′ 6″
2′ 8″x3′ 6″	3′ 0″x4′ 0″	3′ 4″x4′ 0″

13. Doors. The space indicated on the plan for a door is the same width as the door itself; thus for a 3′ 0″ door, a 3′ 0″ space is shown:

DOOR SIZES

Interior, 1⅜″ thick	*Exterior, 1¾″ thick*
2′ 6″x6′ 6″	3′ 0″x7′ 0″
2′ 6″x6′ 8″	3′ 0″x7′ 2″
2′ 8″x6′ 8″	3′ 2″x7′ 0″
2′ 10″x6′ 8″	3′ 2″x7′ 2″
2′ 10″x6′ 10″	3′ 4″x7′ 0″
3′ 0″x6′ 8″	3′ 4″x7′ 2″
3′ 0″x6′ 10″	3′ 4″x7′ 4″
3′ 0″x7′ 0″	

CLOSET DOORS

2′ 0″, 2′ 2″, 2″x4″ in above heights.

Notice that the sill is indicated on outside doors only. The swing of a door is always shown. If the door opens from you and to the right when entering a room, it is a *right hand door;* if to the left, it is termed a *left hand door.*

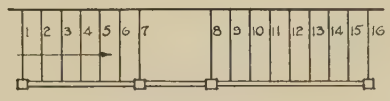
14. Stairs. Before indicating stairs on the plan it is necessary first to know the type which is to be used and the number of *risers* and *treads* necessary. The simpler types are shown on Plate 6. These may be closed; that is, run between walls, or may be open with exposed rail and balusters as shown. The riser is the vertical height from the face of one tread to the face of the next above. The tread is the horizontal width from the face of one riser to the face of the next. The first step in finding the number and sizes of the risers and treads in any stairway is to determine the total rise or the height from floor to floor. For example, assume the ceiling height to be 8′ 6″, lath and plaster ¾″, joists 9½″, rough floor 1″, finished floor ¾″, making a total of 9′ 6″ or 114″ rise. Now for main stairs, each riser varies from 7″ to 7½″ and the tread from 10″ to 11″. For attic and basement stairs, if the space is limited, the riser may be 8″ to 8½″ and the tread from 8″ to 10″. A good rule for proportioning the riser and tread is: the sum of two risers and a tread should be between 24″ and 25″. Thus, if the riser is 7″, the tread will be 10″ to 11″ in width.

Again taking our total rise of 114″, let us assume 16 risers, and by dividing 114″ by 16 we will have 7⅛″ for each riser. Then by applying our rule, riser plus riser plus tread = 24″ or 25″, 7⅛″ + 7⅛″ + tread = 24″ to 25″, or tread = 24″ or 25″ — 14¼″ making a 9¾″ to a 10¾″ tread.

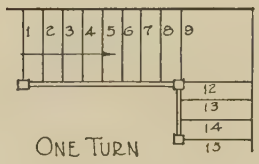
In the plan of a stairway, only the treads are shown. The number of treads is always one less than the number of risers, as the upper floor constitutes the last tread. The risers are usually numbered or, if the plan be broken to show the basement and attic flights, the number of risers is noted: as up 16 risers or down 15 risers, with arrows indi-

STAIRS

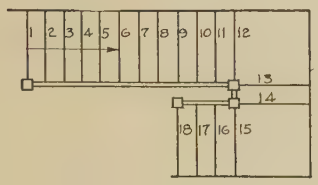
STRAIGHT - RUN



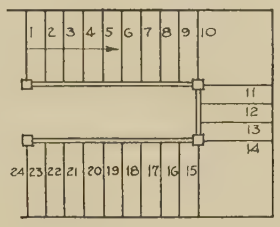
STRAIGHT RUN PLATFORM



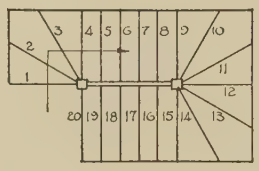
ONE TURN



OPEN NEWEL



OPEN NEWEL



DOG-LEGGED

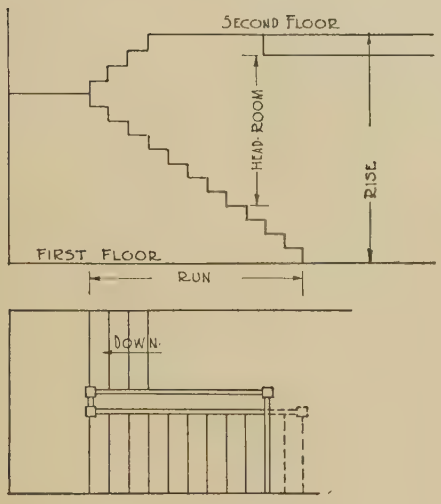
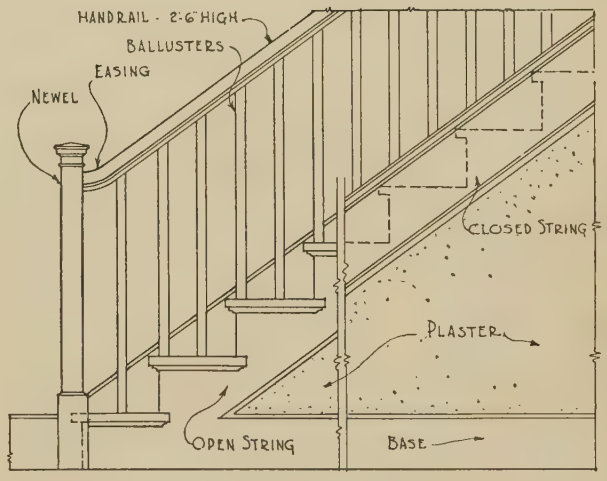
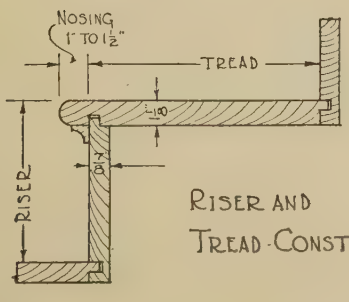


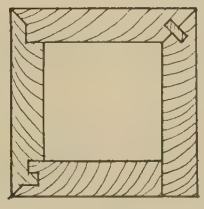
DIAGRAM OF STAIRS



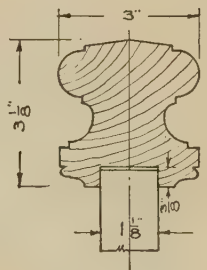
ELEVATION OF TYPICAL STAIRS



RISER AND TREAD CONST



TYPES OF NEWEL CONST



HAND-RAIL DESIGN - VARIES

cating whether the flight is up or down. The stair widths should not be less than 3′ 0″ for main stairs—3′ 4″ or 3′ 6″ including the width of the rail. Basement or attic stairs may be as narrow as 2′ 6″. *Posts* or *newels* average 4″x4″, *rails* 2″ to 3″ wide and 30″ high.

An imaginary break line is used to show two separate flights of stairs on the same plan. When one comes directly over the other, a portion of each flight should be shown. See Art. 55 for further discussion of stairs.

15. Fireplaces. In indicating the fireplace in the plan, the first consideration is the width of the opening. It must be in proportion to the size of the room. The widths vary from 24″ to 48″, the 36″ and 42″ widths being average for residences, with a depth of 16″ or 18″. The depth drops straight back for 4″ and is then sloped or splayed so that the width at the back will be ⅔ that of the opening. (Plate 2.) The height of the opening at the front averages 30″. The size of the *mantel* is kept in proportion to the opening. For a 3′ 0″ width opening a 5′ 10″ width mantel would be proportionate. (Plate 7 also Art. 65.)

16. Kitchen and Pantry Cupboards. The widths of the cupboards are variable to fit the wall spaces. The depth of the upper section is from 12″ to 16″, and that below the counter shelf from 16″ to 22″. Indicate thickness of sides on plan as approximately 2″, actually ⅞″ to 1¼″. (Art 57 and Plate 8.)

17. Bath-room Fixtures, Kitchen Sink, Plumbing. Bath-room fixtures vary in size according to type and space allowed for them. The architect does not, as a rule, detail plumbing, and the fixtures on the ¼″ scale plan are in no sense to be taken as an exact detail of the layout. (Plate 2.) Their arrangement in the bath-room is studied from the point of view of accessibility, and economy of plumbing.

18. Lighting Symbols, Radiators and Registers. All lighting symbols are standard and should be shown in the same manner on all plans. (Plate 1.) The number in the circle for electric lights indicates the number of sixteen candle power lamps. Radiators for steam and hot water are usually placed under windows, the size varying according to the type, number of columns and square feet of radiation required.

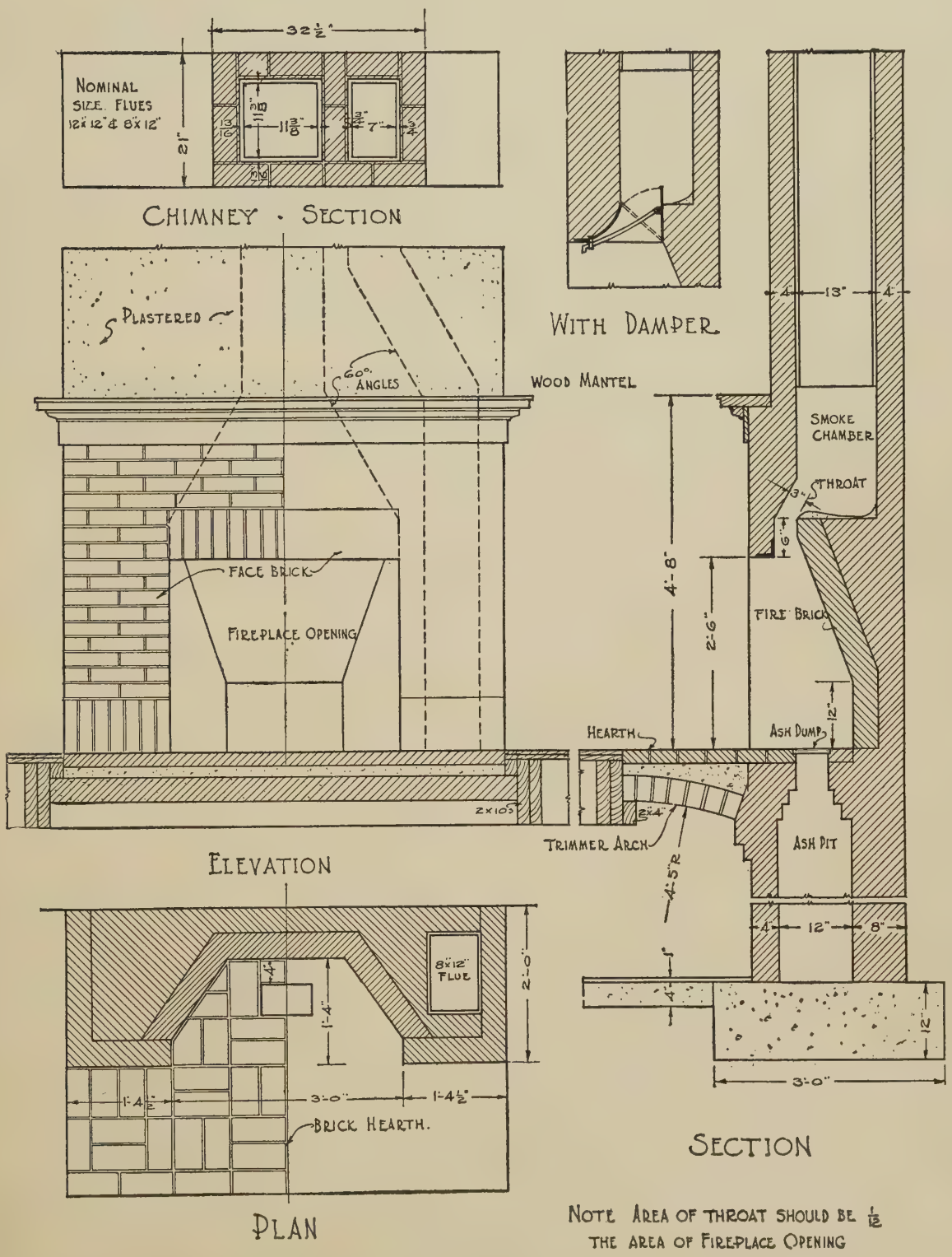
Hot air registers average in size, 10″x12″ or 12″x16″.

19. Furniture Sizes. The following sizes of furniture are given to assist in determining the scale or proportion of the various rooms in which the furniture is to be placed. These sizes should not be taken as arbitrary, but are a general average. Only the two dimensions shown in plan need be considered, the heights being necessary only in the case of kitchen tables, sinks, pianos and buffets, where windows come over them.

Piano, upright	38″x78″	4′ 9″ in height
Library table	30″x48″	
Dining table	48″x48″	
Morris chairs	26″x26″	
Straight chairs	18″x18″	
Rockers	26″x26″	
Buffets	26″x60″	
Ranges	28″x36″	
Kitchen cabinets	26″x48″	
Refrigerator	26″x36″	
Kitchen table	24″x36″	
Single bed	36″x78″	
Double bed	54″x80″	
Chiffoniers	20″x36″	
Dresser	24″x42″	
Book Cases	16″x42″	
Davenport	32″x80″	

20. Room Sizes. The sizes of rooms vary greatly and depend upon a number of factors, the individual requirements of the owner and his standard of living being perhaps the most important. The quantity and position of furniture must also be considered. Most rooms will appear better and be more satisfactory if rectangular rather than square. A large living room is found in all modern homes varying from 12′x18′ up to 18′x24′ or even larger: the dining room 14′x14′, 14′x16′ or 16′x20′; the main hall 7′ or 8′ wide; the kitchen from 9′x12′ up to 14′x16′, the smaller sizes being preferable; bedrooms 10′x12′, 14′x16′ to 16′x 20′; bath-rooms, 6′x9′, 7′x10′, etc.; communi-

FIREPLACE



NOTE AREA OF THROAT SHOULD BE $\frac{1}{12}$ THE AREA OF FIREPLACE OPENING

cating halls at least 3′ wide. The above sizes are only a general average and vary greatly.

21. Inter-relation of Plan and Elevation. Altho the plan and elevation are sometimes spoken of as separate and independent conceptions, they are in reality so closely related that we cannot consider the one without thinking of the other and vice versa. So while working on the plans we should carry the elevations along at the same time at least to the stage of blocking in main outlines and

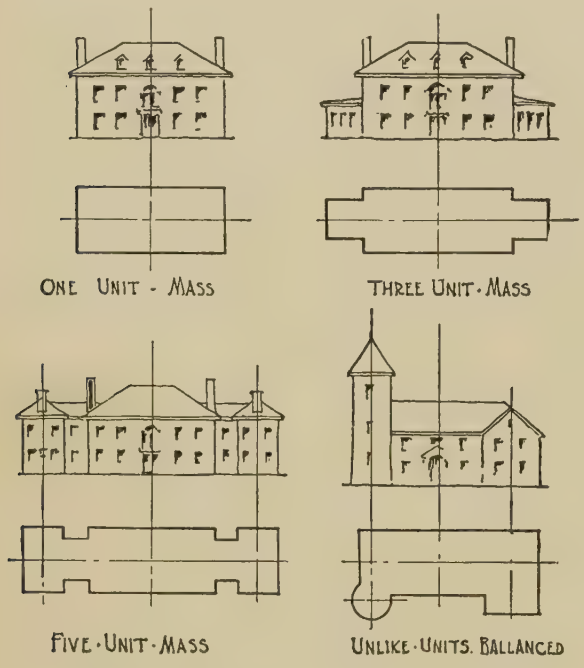


FIG. 10. Proportion and Balance in Design

proportions. The elevation must not be thought of merely as a picture, but *it must be seen in three dimensions,* and must truthfully represent the plan in its main divisions; that is, groups of windows, bays, gables or projections should mark a unit or room of the plan.

22. Development or Design of the Elevation—Principles of Design. The typical styles in house design have already been mentioned in a previous article, along with the characteristics of each. As we have seen, style does not mean misapplied and purposeless ornament, but it is *structural* and *vital.* It should fulfill the purpose for which it is intended and should truthfully express the limitations of the material of which it is constructed. For any particular style selected there are a few simple principles of design, which must be followed; namely, *proportion of masses, unity, balance* and *harmony.* Proportion is the proper relation of the main dimensions and masses or units of a building to each other. The chief cause of failure in the design of buildings is faulty proportion. The numerous examples of small cottages and bungalows with huge, stubby columns, excessive cornice projections and large ornamental brackets, bear witness to the foregoing statement.

In order to have unity in a building, some single feature of interest must predominate, such as a main gable, an interesting entrance, or a long, unbroken roof line.

Balance is obtained by arranging the masses or units of the design either symmetrically or unsymmetrically about an axis. In unsymmetrical design a small mass a greater distance from the axis will balance a larger one near the axis. The symmetrical design is the easiest and simplest for the designer to work with, in order to secure good results. (Fig. 10.)

Harmony is secured by adhering strictly to the forms and details of the particular style used, and avoiding any foreign elements.

A few simple rules may aid the beginner in following these principles in his design:

1. Start with the main axis line centered on the chief feature of the design. Group all subordinate features about it.

2. As far as possible, windows should be placed one above another.

3. Piers, supports or columns should line up one above another. The base of the member above should line with the face of the member below and should not project over the cap.

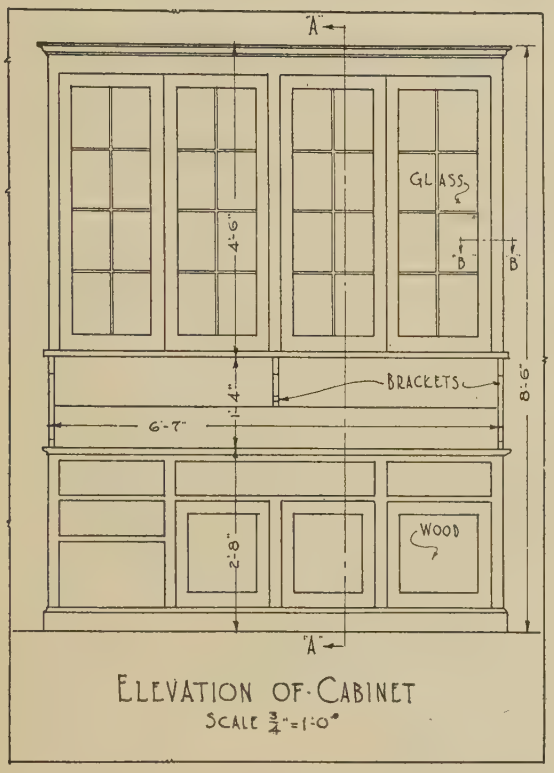
4. Never place a support on the center axis line of the building. An opening should be centered there.

5. Group windows, doorways or arches in odd numbers such as 3, 5 or 7.

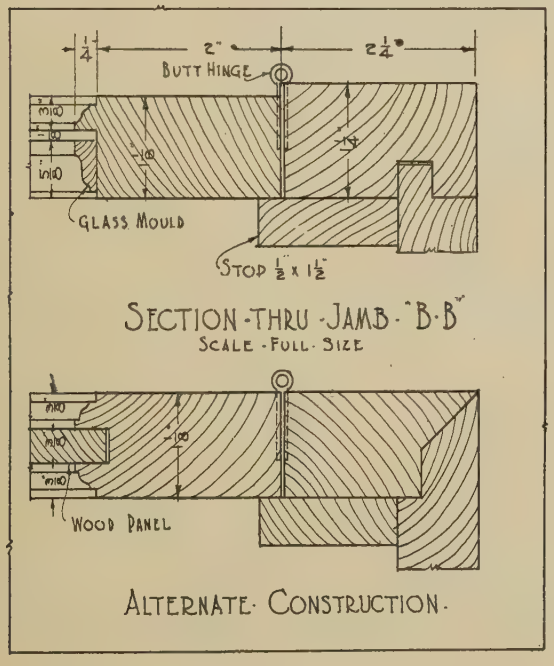
6. Do not place openings too near a corner; it makes the design appear weak.

7. Proportion of windows, doorways and openings should be about twice as high as wide, to look best.

KITCHEN - CABINET

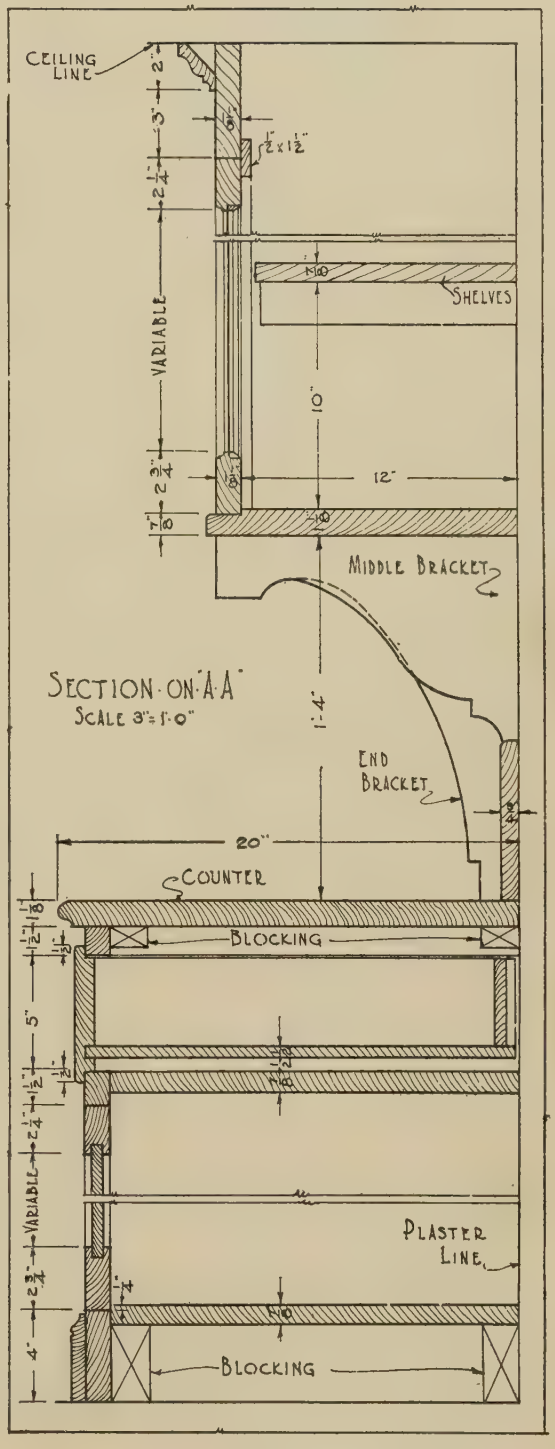


ELEVATION OF CABINET
SCALE $\frac{3}{4}$"=1'-0"



SECTION THRU JAMB "B-B"
SCALE - FULL SIZE

ALTERNATE CONSTRUCTION



SECTION ON "A-A"
SCALE 3"=1'-0"

23. Elevation Description. The drawings of elevations at the ¼″ scale are not symbolized to the extent that the plans are. They are literal pictures or representations of the front and sides of a building in so far as it is possible to show them by means of lines.

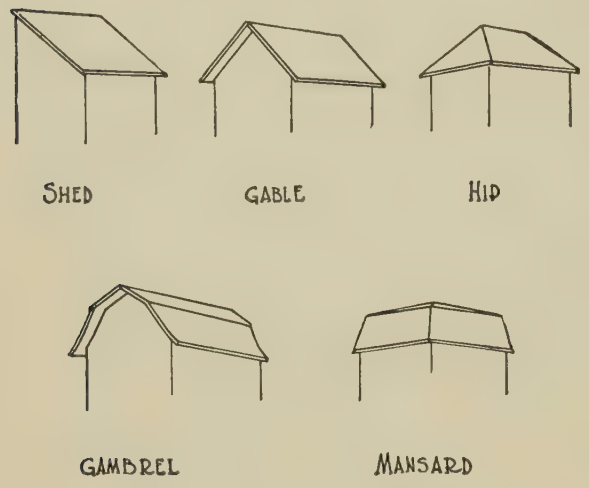


Fig. 11. Types of Roofs

In the description of an elevation, the first line drawn is the grade line. (Plate 42.) This is usually a horizontal line altho it may be sloping to conform with the slope of the site. The natural slope is sometimes shown by a dotted line and the finished grade by a full line.

Next, the story heights must be determined upon and indicated. These heights, which consist of the clear ceiling height and the thickness of the floor construction, are usually laid out at the side of the elevation either on a temporary or a permanent staff or skeleton *wall section.* (Plate 42.) The height of the first floor from the grade depends upon the style of the house and the physical properties of the site. Nearly all two story houses, especially the smaller ones, will appear better if the first floor is kept as close as possible to the grade. This is true particularly when working in the Colonial style.

Light may be secured for the basement by placing the windows below grade and enclosing them in areas or walled spaces, which are covered with an iron grating. If the site is damp, for hygienic reasons it would be better to give the floor-level considerably higher than the grade. It will be found in the average house that this height is from 30″ to 36″. In no case should it be less than 15″, as the sill must be kept above the grade to prevent rotting.

The clear ceiling height for the first floor averages 9′ 0″. In the smaller modern houses it is frequently made 8′ 6″. The thickness of floors depend upon the floor joists. We may figure a 12″ thickness when 10″ floor joists are used and 10″ for an 8″ joist; second floor clear height should be 9′ 0″, 8′ 6″ or 8′ 0″; basement heights, 7′ 0″ to 7′ 6″. The location of the plate and the cornice depends on the height of the attic space desired, also upon style used. (Plate 4.) The skeleton outline should be blocked in on the staff section and the main lines projected to the elevation.

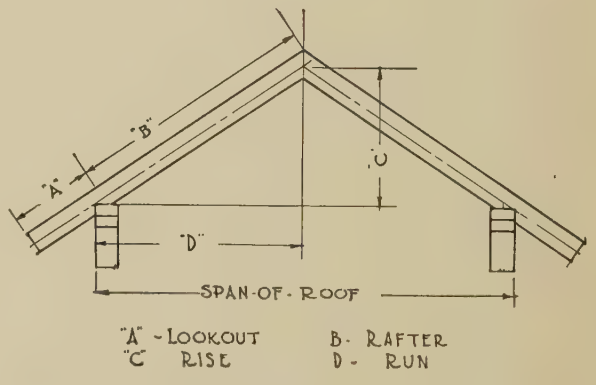


Fig. 12. Pitch of Roofs

24. Roofs. The *shed, gable, hip* and *gambrel* roofs are the types commonly used. The mansard is a type less frequently encountered. (Fig. 11.) The *pitch* or slope of the roof depends on the climate, the architectural style employed, effect desired, and the building materials used. It varies for main roofs usually from ¼ to ½ pitch. (Fig. 12.) The total height of a roof or rise for any pitch is determined by dividing the width or depth

of the house by ¼, ⅓ or whatever the desired pitch may be. For example, if a house is 24'x 30', ⅓ pitch would be ⅓ of 24' or 8'-0" total rise of center of gable or hip.

25. Dormers. As features of an elevation *dormers* should be used sparingly and much study given to their proportions. In drawing the dormer, first block out the width desired. The height will depend upon the attic height and distance from attic floor level. The location of the plate and cornice is determined by a section in a similar manner to the main cornice. (Fig. 28; also Art. 41.)

26. Door and Window Heights. The average height from the floor level of the first floor *double-hung window* is 2' 0". (This height is to bottom of sash) with the exception of the pantry and kitchen windows which should be at least 40" from the floor, to allow for a sink or table under them. Small *casement windows* over bookcases or buffets are approximately 5' 0" from the floor, depending on the cases. The height of the glass for the first floor windows averages 28", 30" or 32" for each sash, making total sash height 5' 2", 5' 6" and 5' 10", which is found by adding 6" to the sum of the two glass heights, made up of 3" for the bottom rail, 1" for the meeting rail and 2" for the top rail. The second floor windows will average about the same heights, possibly a little less, 24", 26", 28" (Art. 12) glass being used. Height from floor, 20" to 24". Stock sizes of glass always come in even inches. Glass size is usually indicated on the elevations. Thus 2L, 26"x28" means a double-hung window with glass 26" wide and 28" high. If the glass is divided into smaller panes by means of *muntins,* it is given thus: 26"x28", divided. Size may also be indicated on plan just inside the windows. However, this method is not always desirable, especially if it is necessary to indicate radiators in plan.

The height of exterior doors averages 7' 0", altho, as noted before, they may vary from 6' 10" to 7' 4" or 7' 6" in height.

27. Exterior Mouldings. *Exterior Mouldings* are found in the cornice, architrave or moulded casings around doors and windows, water table, belt courses, porch column caps and bases, and porch cornices. Their use affords a decorative treatment of otherwise bare wall surfaces and also indicates the architectural style used. Their projecting and receding planes or curves give rise to a

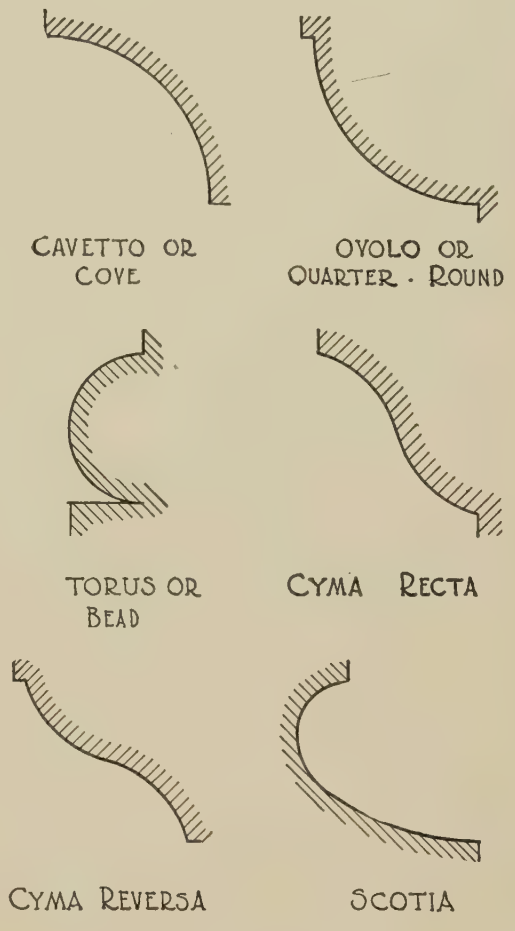


Fig. 13. Classic Mouldings

pleasing play of light and shadow on their surfaces. Most mouldings are based on the classic forms illustrated in Fig. 13. Stock, or universal mouldings are not always found in pleasing shapes. At least one millwork company has had all of its mouldings designed by an experienced and competent architect, thereby insuring good design and proportions.

Millwork catalogs may be obtained upon request from a number of different manufacturers and used for reference work.

28. Exterior Finish. The different materials for exterior finish are bevel siding, clapboards, drop siding, shingles and brick veneer. (Plate 46, also Art. 44.) Light lines spaced according to the material are drawn on the elevations, accompanied by notes specifying the kind of material and its exposure to the weather.

29. Porches and Entrances. The porch, in design, should follow the architectural lines of the house. The cornice should be similar to that of the house. The columns should be properly proportioned and not too massive

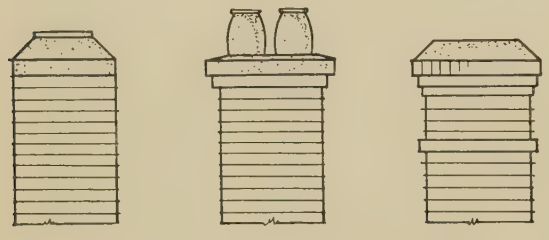


Fig. 14. Chimney Caps

in appearance, the diameters varying from 6″ to 12″ according to the style employed. The clear height varies from 7′ 6″ to 9′ 6″, the average being 8′ 0″ or 8′ 6″. The porch floor is from 2″ to 6″ below the floor of the house; average 4″.

Porch rails are 30″ from the floor and 2½″ to 3½″ wide when built up; when solid they average 1¾″x1¾″. The balusters vary from 1″ to 2½″ square. More and more, the porch is being inclosed in the modern house, making an extra all-the-year room. The windows may be casement, double-hung, or French doors with transoms above. The commoner type is the casement, in groups of three, five or seven sash, which may be equipped with hardware, allowing the entire set to be opened as a unit and permitting a free view without obstructing mullions. (Art. 47, Fig. 31, and Plate 40.)

The main entrance is one of the principal architectural features of any house; as in the Colonial it is the keynote of the style employed. It may have transoms and side lights. (Plate 43.)

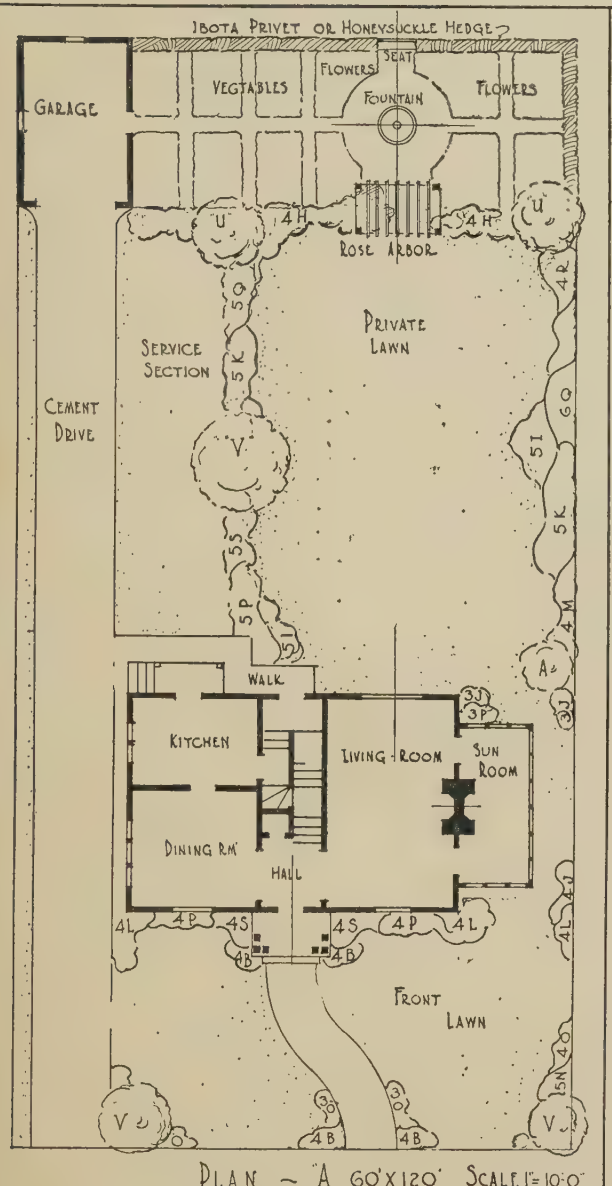
Exposed fireplace walls and chimneys with ornamental caps, if properly proportioned, add much to the appearance of the house. They are also indicative of the style used. (Fig. 14.)

Ornamental conductor heads may be designed or selected from stock. The rectangular conductor pipes or down spouts appear to better advantage than the circular. They should balance with the main vertical axis and form a part of the general design. Their size varies according to the roof surface drained, 2¾″x4¼″ being the average. (Plates 42 and 43.)

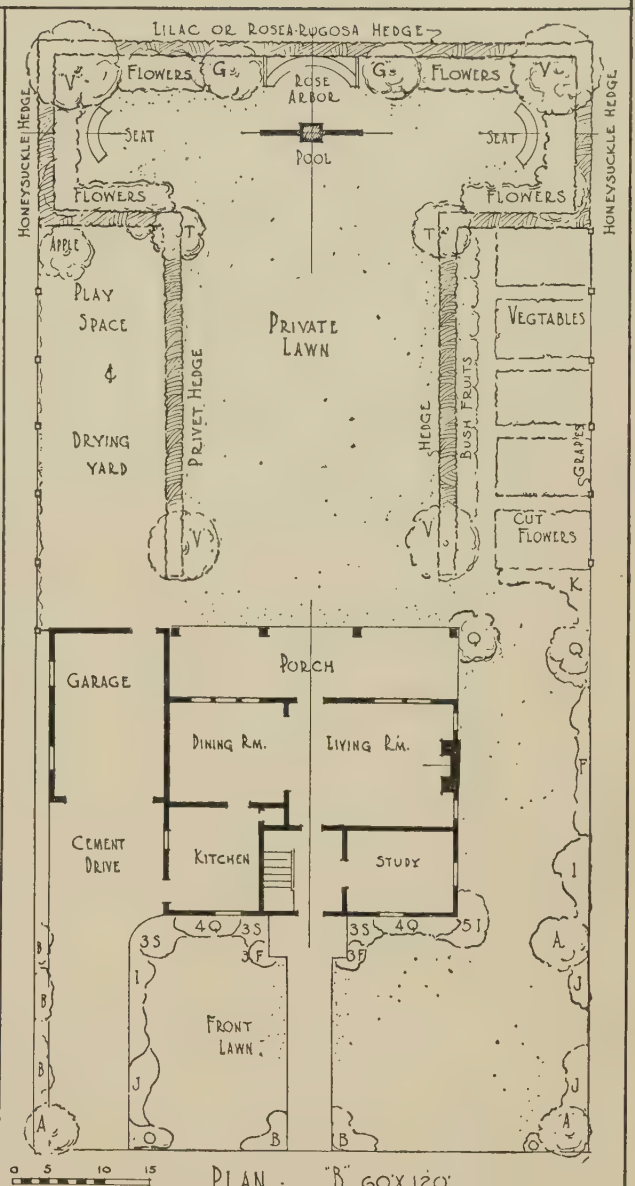
30. Landscape Architecture and Garden Design. The subject of landscape architecture is so broad in its scope that only the landscaping or garden design of the smaller town and suburban houses will be considered here. In the first place, the most successful results are obtained by considering both the house and its site as a whole or unit. If the architect consults and co-operates with the landscape architect or garden designer in the preliminary design of the house and grounds, a more pleasing and harmonious whole is sure to result.

There are two basic methods of planting the garden or landscape. One is the informal or naturalistic style, and the other, the formal, or architectural. The former depends largely on the prevailing natural conditions. Its free lines allow of more or less irregularity in the upkeep, and less exactness in the detail, and is, therefore, less expensive and is more readily kept in condition. The formal garden, on the other hand, is an extension of the lines of the house into grounds. It has nothing in common with a natural landscape. It is balanced and geometrical with regular and controlled planting. Terraces, walks, beds, and constructions, are laid out in parallel and right angle lines, in contrast with the free and flowing forms of the naturalistic garden. The restricted use of bird pools, fountains, statuary, walls, and walks in attractive brick or stone patterns are of great value in carrying out the formal type of small garden,

GARDEN — DESIGN



PLAN — "A" 60'X120' SCALE 1"=10'-0"



PLAN — "B" 60'X120'

KEY-TO-PLANTING

A	MAPLE SUGAR	I	HYDRANGEA PANICULATA	O	RED DOGWOOD
B	BARBERRY	J	WEIGELIA - ROSEA	R	HONEYSUCKLE-TARTARIAN
C	BOSTON IVY	K	LILAC PERSIAN	S	SPIREA-VON HOUTTII
D	AMOOR-PRIVET-HEDGE	L	FORSYTHIA	T	BIRCH-WHITE
E	AMERICAN-PILLAR-CLIMBING-ROSE	M	SYRINGA	U	OAK - RED
F	SPIREA-FROEBEL	N	HONYSUCKLE - MORROWS	V	ELM - AMERICAN
G	LOMBARDY POPLAR	O	SNOWBERRY	W	VIRGINIA CREEPER
H	ROSEA-RUGOSA	P	PRIVET-REGELS	X	DORTHY PERKINS

PLATE 9

or adding a formal touch to the naturalistic garden. The informal or naturalistic style is well adapted for the small suburban or town lots. As before stated, it is less expensive, and more easily kept up.

The entire area is usually divided into three sections. The portion in front of the house, between it and the street, is the front lawn or public area. The areas consisting of the private lawn and the service yard are located to the rear of the house. The latter is closed or screened from the rest with heavy planting or even with walls. It consists of the clothes yard, vegetable and flower gardens, and garage. (Scheme A, Plate 9.) This arrangement shows a typical informal planting for the Dutch Colonial House of Plates 39 to 43, on a lot 60′x120′. Here the garage is located where it should always be, when not connected with the house; namely, at the rear and in one corner of the lot, where it will not break into the available planting space. The main axis of the private lawn centers on the windows of the living room, from which a pleasing vista thru the rose arbor to the fountain is obtained. The service portion and the kitchen door is screened by heavy planting from the lawn. In front of the house near the entrance are masses of shrubs which conceal the foundation and tie the house to the ground. The vegetable garden at the back of the yard may be enclosed either by a fence or hedge, the fence being least expensive. In scheme *B*, Plate 9, a rather formal arrangement is shown, the lines of the hedge carrying out the main lines of the house, with the lawn centering on the rear door. Across the open lawn may be seen the pool with the rose arbor in the background. The drying yard and vegetable gardens on either side of the lawn are screened by a hedge. A suggested planting is shown for both schemes. The planting for a small lot should be so arranged as to give apparent spaciousness and depth. Trees, shrubs, vines, and flowers are the elements used to give the required effects. Trees are planted for shade (one or more on the lawn, and others where possible to shade and frame-in the house) to add interest to the sky line, to form borders, to act as frames for distant views, to act as wind-breaks, and lastly for their own individual beauty. Shrubs, according to "Bailey," are planted:

1. To add furniture to the area.
2. To make the boundary areas real.
3. To supply borders and to cover high foundations.
4. To develop interest in the general lines.
5. To add variety and interest to the different species.
6. To cover up errors in grade and contour line, and to afford flowers and attractive fruits.

Shrubs are used in groups and masses—not as single specimens—to get a massed effect in color and shape. Vines should be planted to cover brick or stone walls or chimneys, as screens in places too narrow for shrub planting, and for arbor covers. Flowers may be planted along the edge of shrubbery masses or along walks or in beds in a separate flower garden.

The best ten shrubs, and those which are most immune to scale and insect attack are as follows:

1. Barberry (Japanese).
2. Spirea Von Houtti.
3. Syringa (Mock Orange.)
4. Hydrangea Paniculata Grandiflora.
5. Weigelia Rosea.
6. Snowberry.
7. Honeysuckle (Tartarian and Morrows).
8. Privet (Ibota and Regels).
9. Forsythia Intermedia.
10. Persian Lilac and Common Lilac.

The planting should in all cases be of shrubs or trees indigenous to the climate, and should be those which will harmonize best with the style of architecture employed, and always the house is the keynote of the planting picture. It dicates or suggests the type of planting used. The foundation planting unites house and grounds, while trees are used to complete and frame-in the picture.

CHAPTER III

Construction—Carpentry

31. Framing. The first step in the actual construction of a frame building, after the foundation walls are in (Art. 58), is to erect the skeleton frame. The different types of frame are the *full, braced* or *combination, Western,* and *balloon* frames. The full frame consists of heavy timbers with all of the joints mortised, tenoned and pinned. It resembles certain types of barn framing which still prevail in certain localities. It is practically obsolete now due to the growing scarcity of timber and the length of time required in its erection. The braced or combination frame has a solid *sill* which is half lapped at the corners, solid corner posts, heavy braces at the corners and secondary sills called girts at the second floor. It is still used to some extent in the better and heavier types of houses, altho not as widely as the balloon or Western frames. (Fig. 15.) The Western frame is a variation of the balloon frame. Instead of the studs being continuous, they run only to the second story, where a secondary sill is used, which is practically a repetition of the sill at the first floor. The balloon frame, which is now used in nearly all residence work, is a lighter type than the three preceding, and uses a minimum of material. It is put together entirely with nails and nothing thicker than 2″ stock is used. The studs extend from the sills to the plate. The chief objection to the balloon frame is its fire hazard. The space between the studs should be thoroly blocked with fire stops to overcome this. (Fig. 16.)

Since the balloon frame is most typical, we will consider its construction in detail.

32. Sill. The sill is the timber or timbers laid on the foundation wall to support the floors and walls above. There are two typical, *box* or built-up sills, in balloon construction. The first type consists of a wall plate

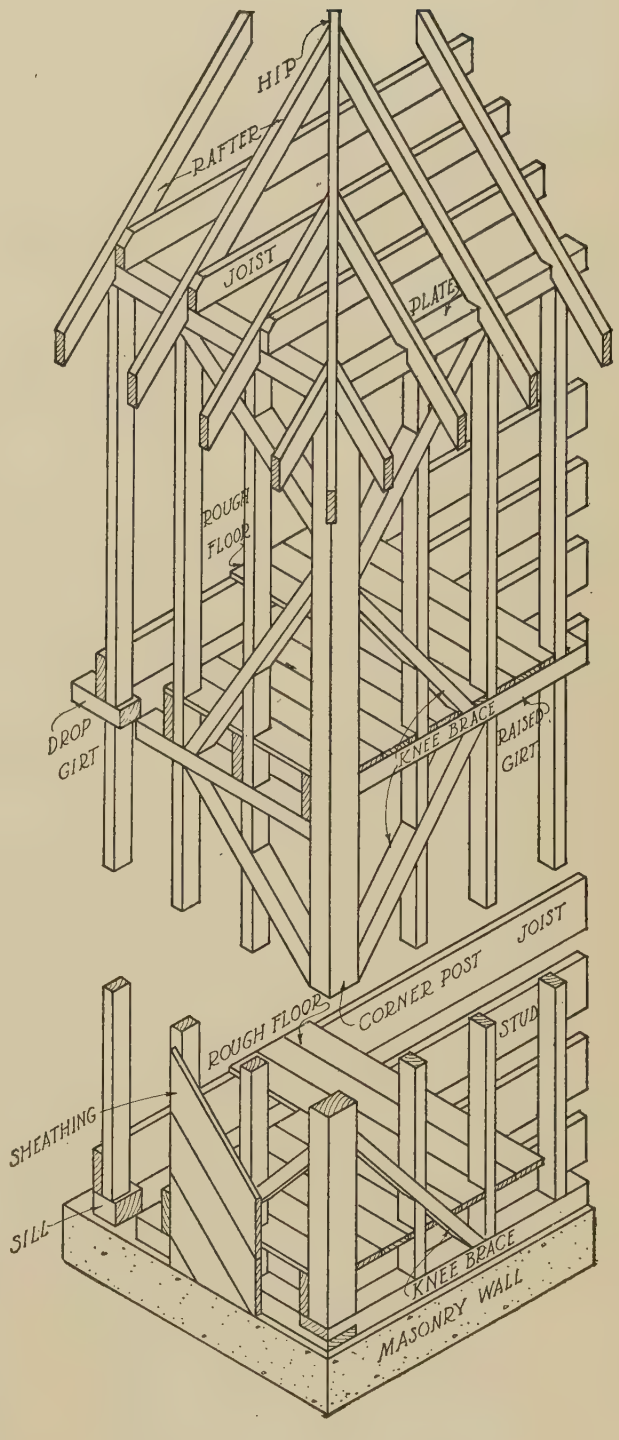


Fig. 15. Braced Frame

bedded in mortar and set back 1″ from the face of the foundation wall. On the outside edge of this plate, is placed a *header,* usually a 2″x8″ or 2″x10″, into which the floor joist butts. On top of this, comes a rough ⅞″ floor, then a 2″x4″ laid flat-wise, called a *sole,*

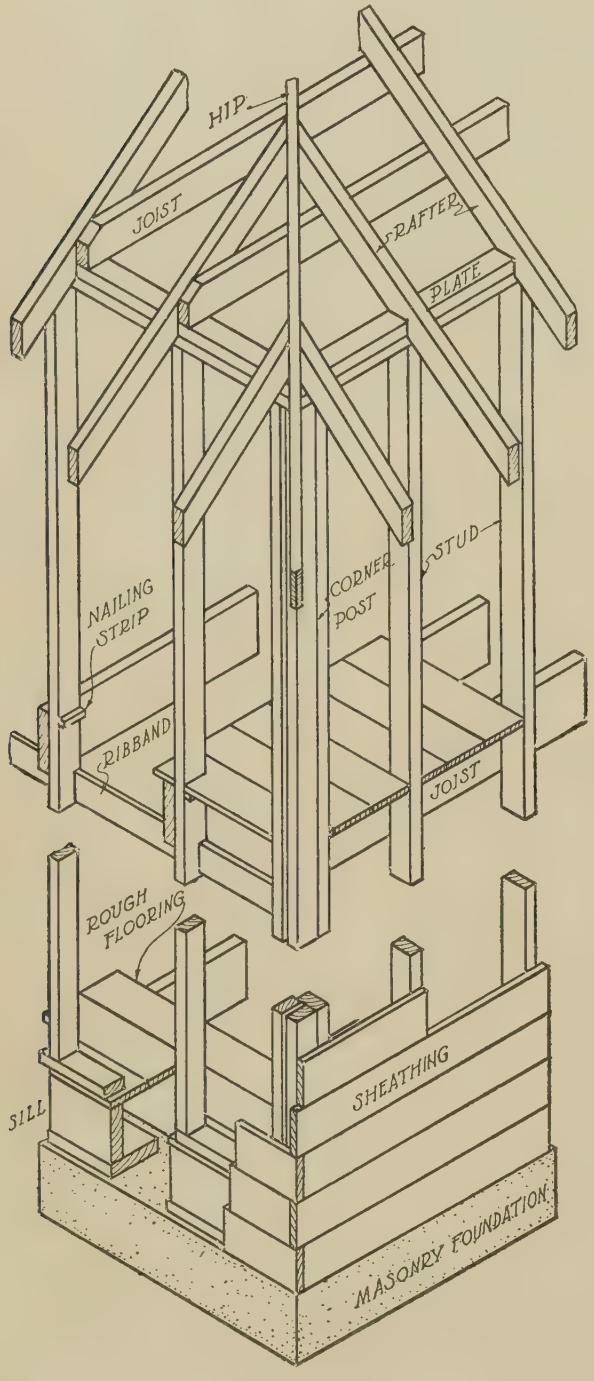


Fig. 16. Balloon Frame

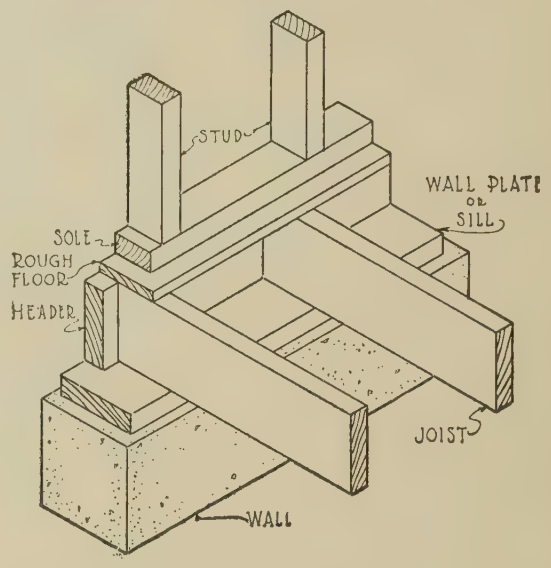


Fig. 17A. Box Sill

upon which the 2″x4″ studs rest. (Fig. 17A and Fig. 29.)

The second sill is called the *T-sill,* and is commonly used in some localities. It is similar to the first type, with the exception that the studs extend down and rest on the wall plate and the header comes inside the studs. This type should be thoroly fire stopped (Fig. 17B) as should also the sill shown in Fig. 17C, which is not as generally used as the other types.

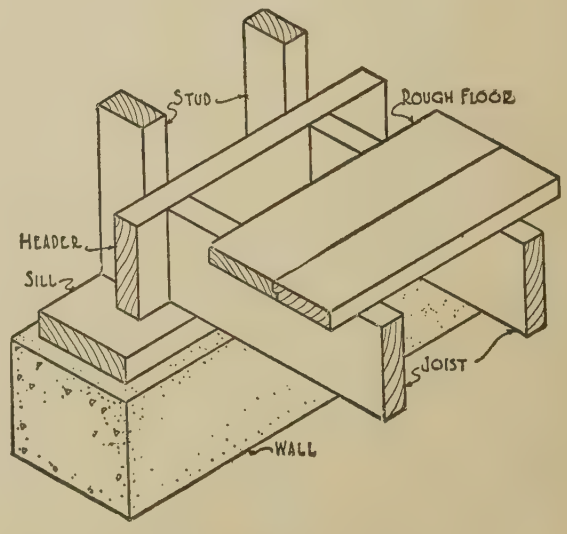


Fig. 17B. T-Sill

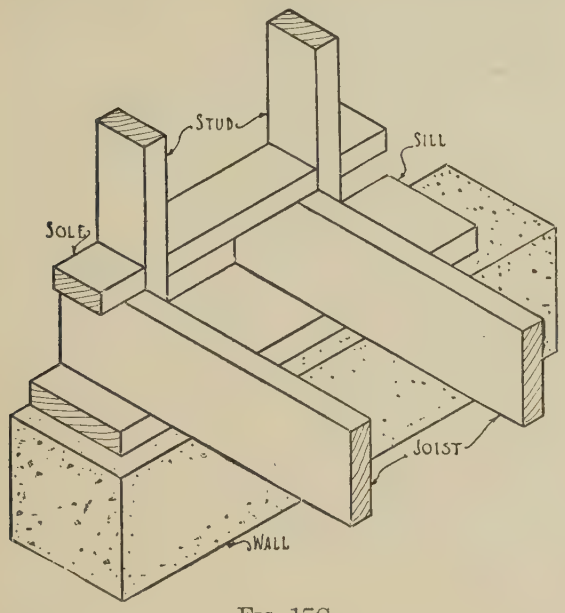


FIG. 17C

33. Girders are horizontal timbers used midway between the foundation walls to support the floor joists. They may be solid, such as 4″x6″s or 6″x8″s or built up of two 2″x6″s or three 2″x8″s. When a very rigid support, without any danger of shrinkage is desired, a steel I-beam may be used.

There are two ways of framing the girders and joists. The first and cheapest is merely to rest the joists on top of the girder. (Fig. 18A.) In the second method, the joists head into the girder with their lower edges notched over a 2″x4″ or 2″x6″, which in turn is spiked to the side of the girder. (Fig. 18B.) The latter method is more satisfactory as it gives more clear head room in the basement and less shrinkage.

34. Floor Joists vary from 2″x6″s to 2″x 12″s, depending on spacing and span. They are usually placed 16″ on centers, owing to the stock length of lath which is 48″. This makes the lath always break joints on the joists. A spacing of 12″ is also used. The span is the distance between joist supports. Spans of over 8′ 0″ should be bridged. *Bridging* consists of short pieces 1″x3″ or 2″x3″, set diagonally between joists to stiffen them laterally.

35. Headers and Trimmers. Around stair and fire place openings, it is necessary to double the joists at the sides. These joists are called *trimmers.* They support short joists running at right angles, which are the *headers.* These, in turn, support and carry the weight of the tail joists and floor. (Fig. 19.)

A clear 2″ space should always be left between the trimmers and chimneys or fireplaces.

36. Studs are the 2″x4″ vertical uprights, which rest upon the sill. They are spaced the same as the joists and for the same reason. For heavier structures, 2″x6″s may be used.

At the corners, the studs are usually tripled and offset to afford a nailing for the lath.

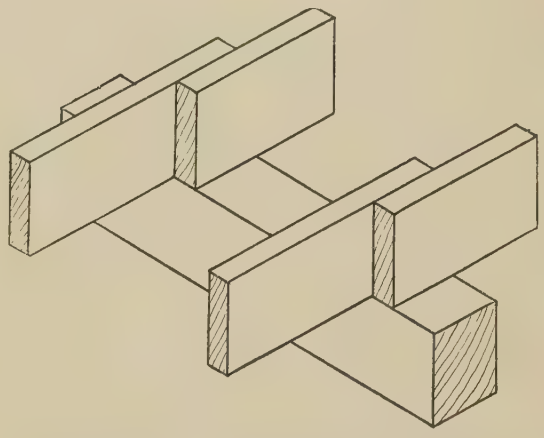


FIG. 18A. Girder and Joist Framing

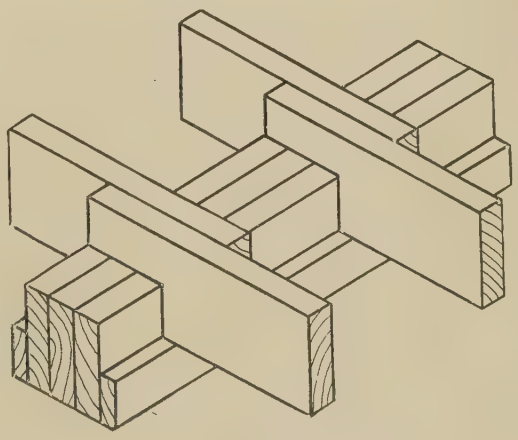


FIG. 18B

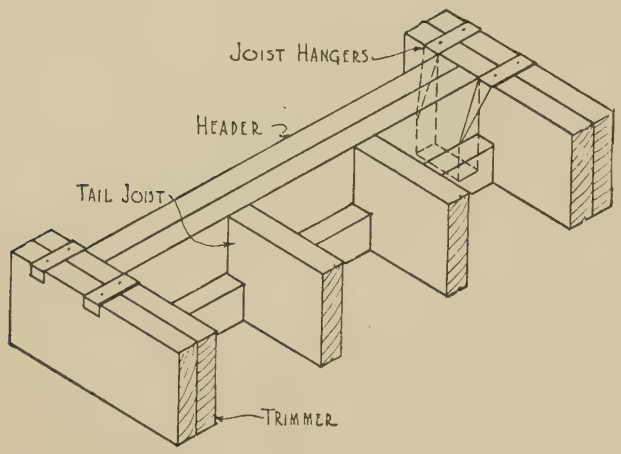


FIG. 19. Header and Trimmer Construction

(Fig. 20, A, B and C.) Horizontal bridging should be cut between studs to stiffen the walls and to act as fire stops.

37. Girts, which are found in the combination frame, are secondary sills coming at the second floor level, whose purpose is to support the second floor joists. (Fig. 15.) The *ribband* or *ledger board* fulfils a similar purpose in the balloon frame. It is usually a 1″x6″ board cut into the inside of the studs to support the joists which are notched 1″ over it. (Fig. 21.)

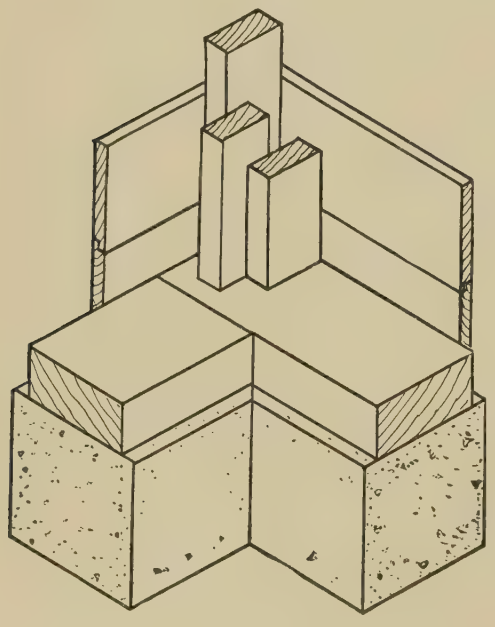


FIG. 20A. Corner Framing of Studs

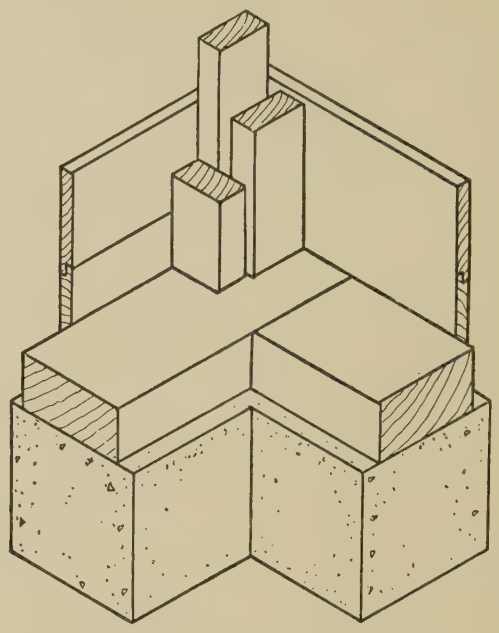


FIG. 20B

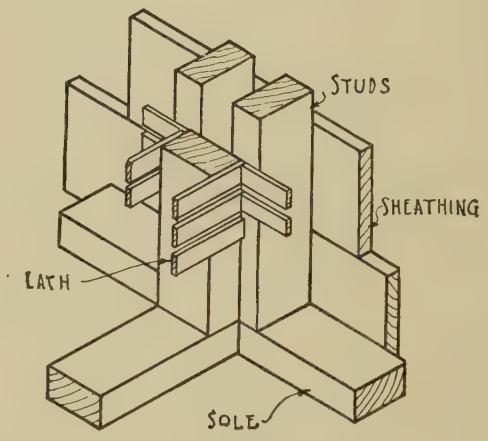


FIG. 20C

38. Inside Partitions. In inside partitions, the studs rest upon a 2″x4″ sole piece, placed on top of the rough flooring. Where partitions of the second floor come above those below, other methods may be used in placing the studs. (Fig. 22, A and B.) The method that will equalize the shrinkage of wood in the center and side walls is always the best.

Floor joists are always doubled under partitions.

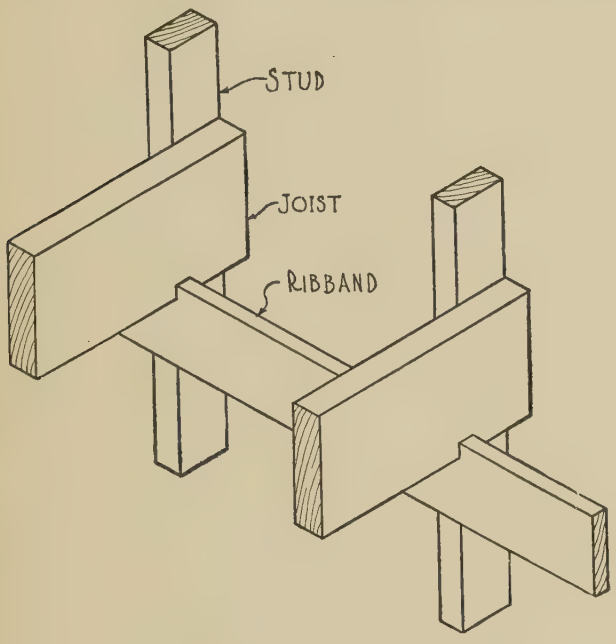


FIG. 21. Ledger Board or Ribband

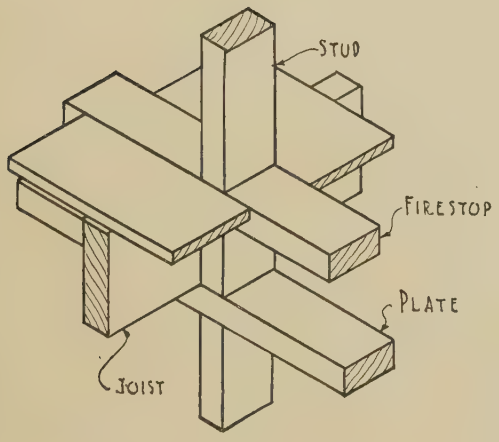


FIG. 22A. Inside Partition

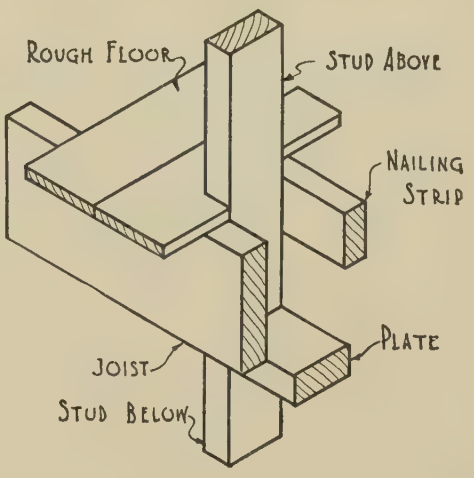


FIG. 22B. Inside Partition

39. Window and Door Openings For all door and window openings, the studs should be doubled at the sides and a double 2″x4″ header placed over the opening; also either a single or a double 2″x4″ under the window.

All openings over 3′ 6″ in width should be trussed. (Fig. 23, A and B.)

The stud opening for a window is found from the glass size, by adding 10″ to the width of the glass and 11″ to its height. For example, take a 30″x32″ glass and allow 2″ in width for the sash at either side, 1″ for the pulley stile and 2″ for the weight box, making a 10″ total for both sides or a 40″ width stud opening.

In height allow 2″ for the sill, 3″ for the lower rail, 1″ for the meeting rails, 2″ for the top rail, 1″ for the yoke and 2″ to 3″ for the lugs on the frame, 32″ + 32″ for the glass, making a total stud opening of 74″ or 75″. For a 3′ 0″x7′ 0″ door, a stud opening of 3′ 3½″x7′ 5″ is allowed. (Fig. 24.)

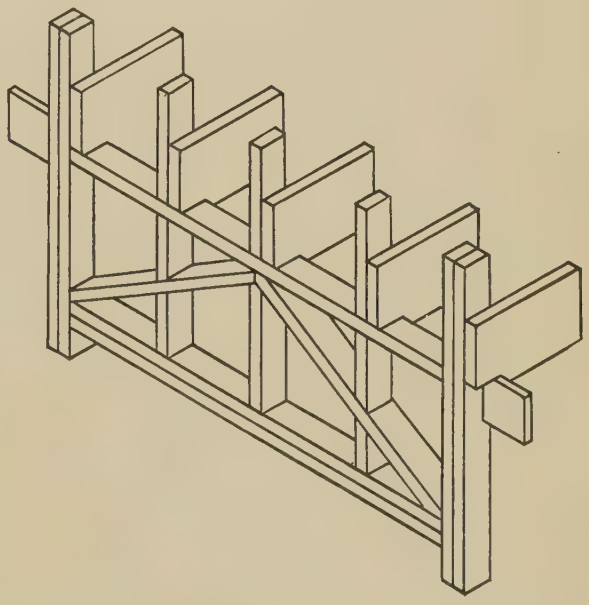


FIG. 23A. Trussing over Window or Door Opening

40. Roof Construction. The various types of roofs have been considered elsewhere, also the method of determining the pitch or slope of the roof. The principal framing members of the roof are the *plate, common rafters, jack-rafters, hip rafters, valley rafters, cripple rafters* and the *ridge.* (Fig. 25.)

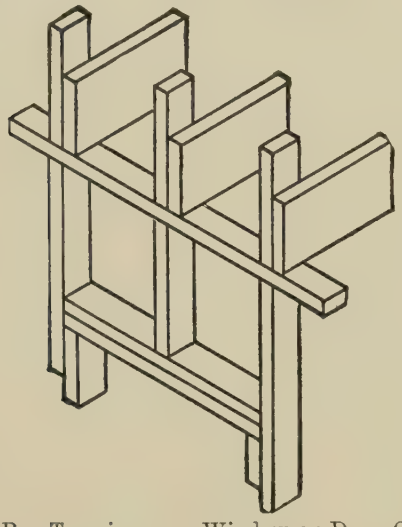


Fig. 23B. Trussing over Window or Door Opening

The plate is a horizontal member composed of two 2″x4″s or two 2″x6″s resting on the ends of the studs and affording a seat for the rafters. The rafters are either 2″x4″s or 2″x6″s, spaced 16″ on centers. Their purpose is to support the roof boards and roof covering.

It will be seen from the illustration that the common rafters run from the ridge to the plate; jack rafters from hip or valley to plate and cripple rafters from valley to hip. The hip and valley rafters are always found where two roof surfaces intersect, the exterior angle being the hip and the re-entrant angle the valley. *Purlins* are secondary plates supporting the rafters midway of their length or where a break in the roof slope occurs. (Fig. 25.)

Collar beams are horizontal ties from rafter to rafter, used to stiffen the roof construction and prevent spreading. *Trusses* are used on long, clear roof spans, where intermediate supports are not desirable.

The lay-out of a typical roof plan will now be considered. Given the plan in Fig. 26, first lay out the largest possible rectangle containing the main part of the plan as W, X, Y, and H. From each corner of this rectangle draw lines at 45° meeting at points A and B. Connect A with B and we have a simple hip roof.

It is now necessary to cover the projections. We will assume the one at the upper right is to have a gable roof, and the remainder to have hip roofs. Draw a center line for the gable ridge from point N until it intersects the hip line B X at M. Then, since the slope or pitch of the roof is the same as that of the main roof, line X M may be erased. However, it should be remembered that this line represents the hip rafter in construction and actually carries to the plate on the inside of the roof.

Now draw line M Q at 45° representing the valley rafter. To roof the hip projections draw lines at 45° from points K L; G V; and U T intersecting at points D, F and R respectively. From points R and F the ridges are extended to meet the hip lines of the main roof at points S and E. Point C is located in the first hip by the intersection of 45° lines from I and J. The main roof hips from S to W and E to Y will not be seen, as the slope of the projections are

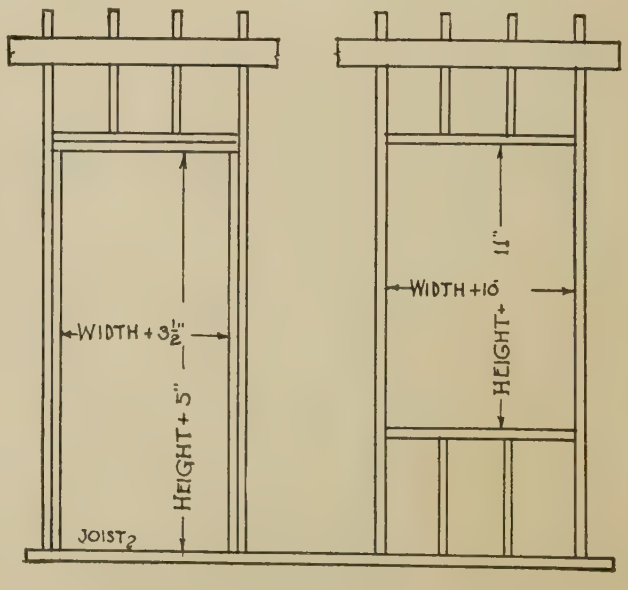


Fig. 24. Stud Opening for Door and Window

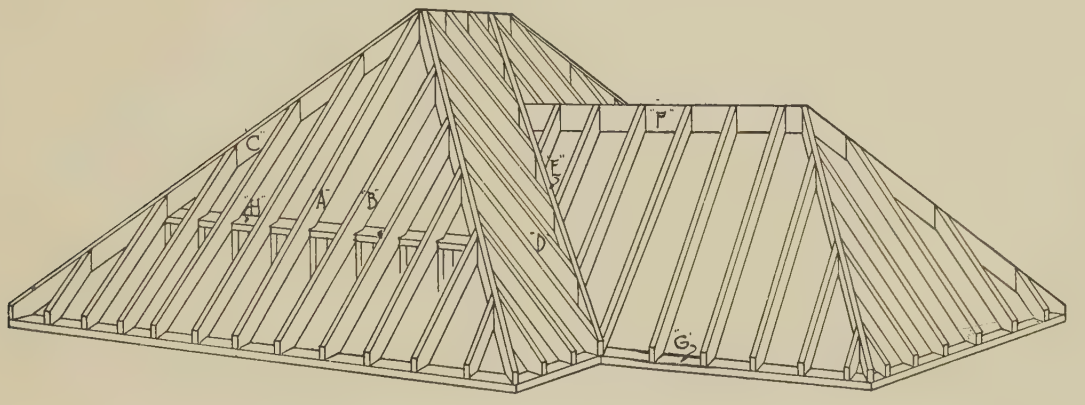


Fig. 25. Perspective of Roof Frame Illustrating Various Rafters

the same as that of the main roof, as in the case of the gable at X M. The same roof points are shown in front and side elevations. See Fig. 27 for the plan of a simple Dutch Colonial roof.

41. Dormers. "Dormer" is the name applied to all windows in the roofs of buildings. There are numerous types. (Fig. 28.) They may rest entirely on the roof or may be a continuation of the side walls of the house above the line of the main cornice, with the cornice either broken or continuous. The framing about the dormer opening in the roof is similar to the header and trimmer construction about a fireplace. The trimmer rafters at the side are doubled. The header at the back is placed at right angles to the slope of the rafters, while the one under the dormer sill is placed in a vertical position. The framing of the dormer is similar to that of the main roof. The vertical studs of the side walls rest on the trimmer rafters and the ceiling joists and rafters seat on a 2″x4″ plate.

42. Sheathing. After the skeleton framework of the building is up, *sheathing* or sheeting, so called, is applied to the outside face of the studs. This consists of ⅞″ boards,

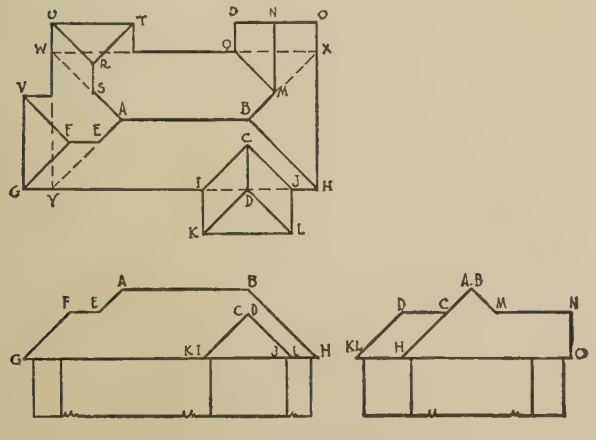


Fig. 26. Method of Laying Out a Roof Plan

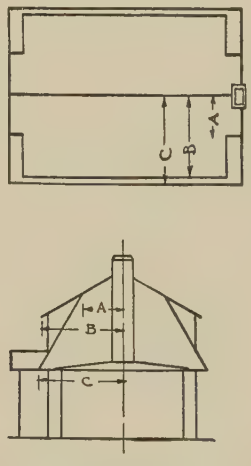


Fig. 27. Dutch Colonial Roof Plan

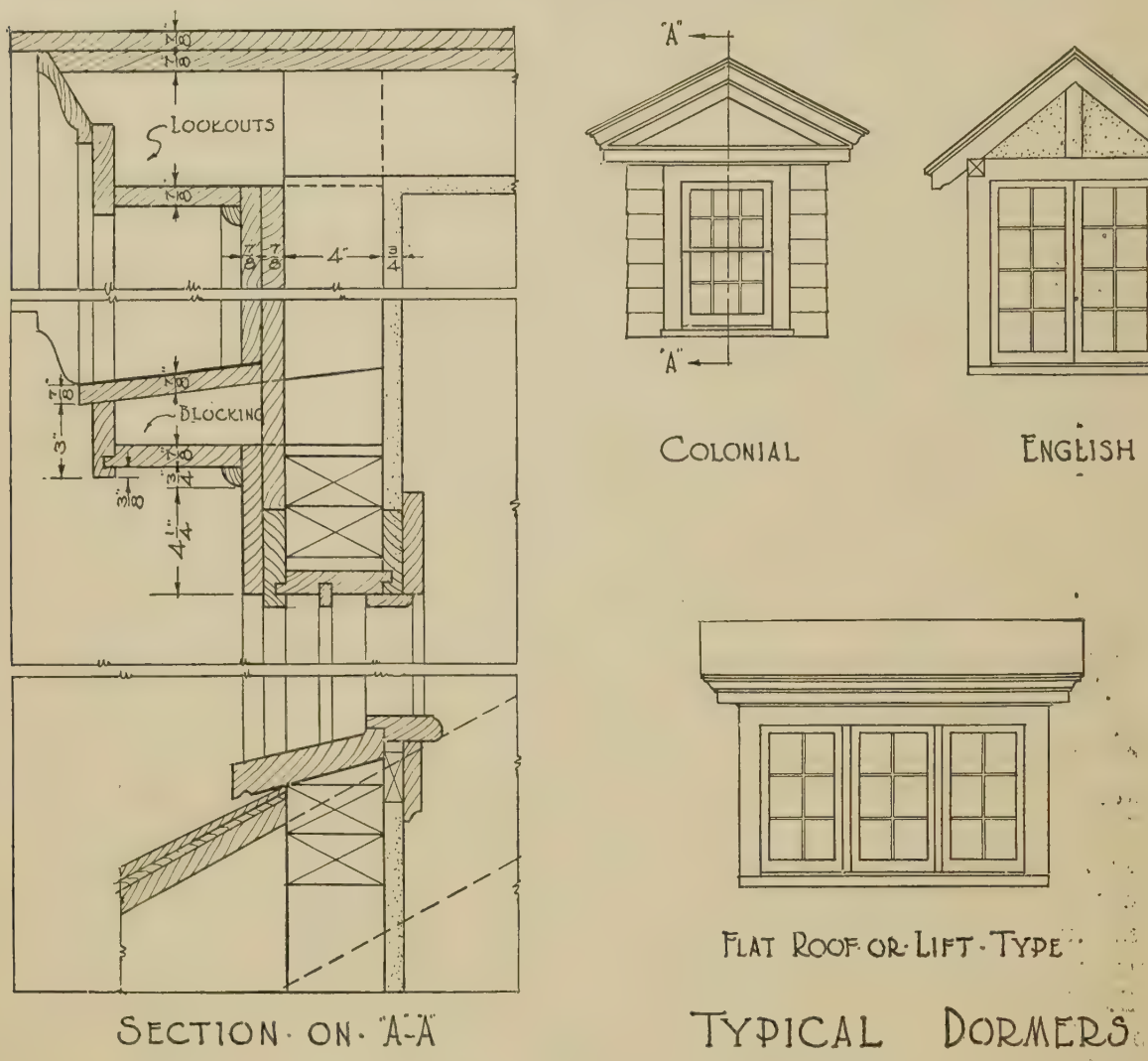


FIG. 28. Types of Dormers and Dormer Construction

placed either diagonally or at right angles to the studs, the former method making a more rigid construction.

43. Water Table. Starting at the bottom, the *water table* is placed over the sheathing and forms a transition from the masonry foundation to the wood superstructure. It sheds the water and prevents it from seeping in under the sills. The projection of the water table depends on the distance the studs are set back from the face of the foundation wall. The commonest type is shown in Fig. 29. The water table laps over the masonry wall about 1". The drip cap is flat on the bottom and beveled on the top with a projection up behind the siding which sets the last course of siding out at the same angle as the others. The projection of the cap beyond the water table board may be such as to allow a moulding underneath.

44. Outside Wall Coverings. Of the outside wall coverings for a house, siding is the most common. There are two types: *drop* and *bevel*. (Plate 3.) Drop siding is often moulded. The beveled siding is more desirable as it is quarter-sawed and is usually more attractive, especially in the wider sizes. Cypress, redwood and pine are the most durable woods for siding.

Shingles are frequently used for outside

walls. They are exposed about 5″ to the weather and are stained any shade or color desired.

Shiplap (Plate 15) is occasionally used in place of siding. With this as well as all wall coverings, a layer of good building paper should first be placed over the sheathing before applying the wall covering.

When *stucco* is used the sheathing may be omitted. If omitted, the frame should be securely braced by 1″ boards let into the inside of the studs. When not omitted, *furring* or nailing strips of 1″ in thickness are placed over the sheathing and either narrow split wood lath or metal lath are nailed to these to form a base for the stucco. (Fig. 30.)

45. Cornice Construction and Finish. There are two kinds of frame cornices, *open* and *box*. In the open cornice the rafter ends or lookouts are exposed. (Plate 4.) The *frieze* is cut between the rafters, and a *bed mould* is placed between the frieze and the underside of the roof boards. The roof boards forming the *soffit* should be T and G (tongued and grooved). The finish at the end of the rafter may be only a mould, with the rafter end cut to an ornamental design, or the rafter ends may be cut square and a flat board or *fascia* with a *crown mould* nailed to them.

The open cornice may have a hanging metal gutter, a gutter built on the roof or one cut in the rafter ends. (Plate 4.) The skeleton of the box cornice is formed by the projection of the rafter ends and lookouts, which are short pieces of 2″x4″s nailed between the rafter ends and the studs. To the underside of the lookouts, is nailed the soffit

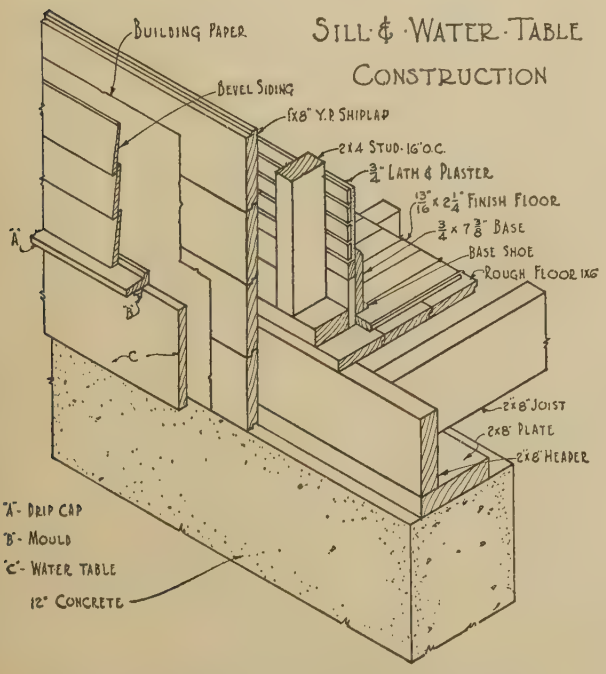


Fig. 29. Water Table and Sill Construction

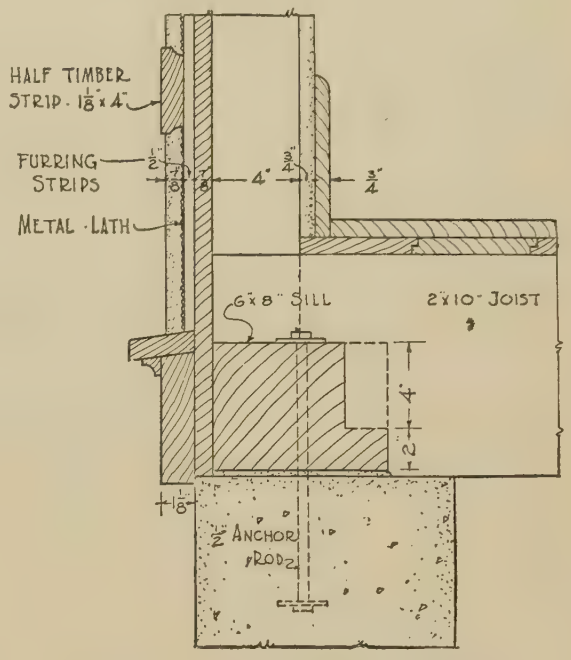


Fig. 30. Sill and Stucco Construction

or *plancher;* this may be a ⅞″ board or, on wide projections, T and G or V-beaded ceiling. To the rafter ends is nailed the fascia, a ¾″ or ⅞″ board, which projects ⅜″ below the plancher. On this, comes the crown mould, usually a 4″ to 4½″ mould covering the edge of the roof boards and setting up under the projecting shingles, which overhang 1″ to 1½″. The frieze is placed, where the wall of the house meets the underside of the cornice. This is a 6″, 8″, or 10″ board ⅞″ or 1⅛″ in thickness, rabbeted at the lower edge to receive the siding. Covering the joint between the frieze and plancher is the bed

mould, a 2½″ to 3½″ mould. A hanging gutter is used on this type. For other variations of the box cornice see Plate 4. There are also a number of different types and styles of gutters. They vary from 4″ to 8″ in width, depending on the roof surface to be drained, and have a pitch of 1″ to 20′ 0″. *Conductor pipes* or *down spouts* are either round or rectangular. The round average 3″ in diameter and the rectangular 2¾″x4¼″.

46. Roofing. Wood shingles as a roof covering are most extensively used. They are made of cypress, cedar, redwood, pine or spruce. They should not be used on roofs of less than ¼ pitch. In size they vary from 16″, 20″, 24″ to 36″ in length and from 2½″ to 12″ in width, with a thickness of ⅜″ at the butt and approximately $\frac{1}{16}$″ at the opposite end. They are laid with an exposure to the weather of from 4″ to 4¾″, depending on the pitch of the roof. The steeper the pitch the greater the exposure. Asbestos or composition shingles should be laid over a D and M (dressed and matched) board roof covered with waterproof paper. They are durable, suffer little from climatic conditions and have the advantage of being fire-proof. They are widely used and may be laid according to the French diagonal method or the American horizontal style.

Slate comes in sizes from 7″x9″ up to 24″x44″ and from ⅛″ to ¾″ in thickness, average $\frac{3}{16}$″ or ¼″. It should be laid with a lap of 3″ over the second course below.

Tile are made in several forms: Spanish, pan, Ludowici, and plain. The plain is the more common. Plain tile comes in an average size of 6¼″x10½″x⅝″ and is laid one-half its length to the weather. Tile weighs from 750 to 1,000 lbs. per 100 square feet; therefore roof construction must be made heavier, 2″x8″ rafters being ordinarly used with tile.

There are several kinds of prepared roofing on the market, made of paper, felt or asbestos paper and coated with water-proofing compounds. The edges are cemented down after the roofing is in place.

47. Porch Finish. The porch may be supported by a continuous foundation extending at least 4′ 0″ below grade or by piers of either brick or concrete at the corners. The continuous wall looks better, but it is more expensive.

The floor joists are 2″x6″s or 2″x8″s, 16″ on centers, running parallel with the wall of the house and heading into girders. (Fig. 31.) On top of the joists is a single thickness floor, usually of fir, T and G (tongued and grooved), 1⅛″ thick, with a 2¼″ face. The porch columns resting on the floor over the piers may be either solid or built up, in square, rectangular or circular forms. On top of the columns is a built-up or trussed beam, concealed by a ⅞″ or ¾″ boxing, forming the frieze and soffit. The rafter, ceiling joists, fascia, plancher, crown mould and gutter are similar in size and shape to those of the main house cornice. The porch ceiling is T and G or B and M and V'd in ⅜″, ⅝″ or ¾″ thickness, finished to $\frac{5}{16}$″, $\frac{7}{16}$″, $\frac{9}{16}$″, and $\frac{11}{16}$″. The widths are the same as those of flooring. A cove or similar mould is placed at the intersection of the inside frieze and ceiling.

If the porch is narrow and the roof is made gabled at the front, the crown mould should not carry across horizontally, but should follow the slope or rake of the gable. Plate 4 shows how this rake mould section is determined. Porch roofs are usually nearly flat and covered with tin, or in the case of a flat deck, with canvas properly prepared and waterproofed.

48. Flashing. It is vitally essential, wherever a dormer, chimney or roof intersects a roof, or where a roof surface meets a vertical wall, as in the case of porches, to cover or flash the intersections with tin, copper, zinc or composition. The flashing should extend high enough to prevent water from backing up over it.

49. Lath. Wood lath are 48″ in length and 1″ to 1½″ in width and ¼″ in thickness and spaced ¼″ to ⅜″ apart. Lath break joints every eight to twelve courses. On masonry walls, lath are nailed to furring strips, leav-

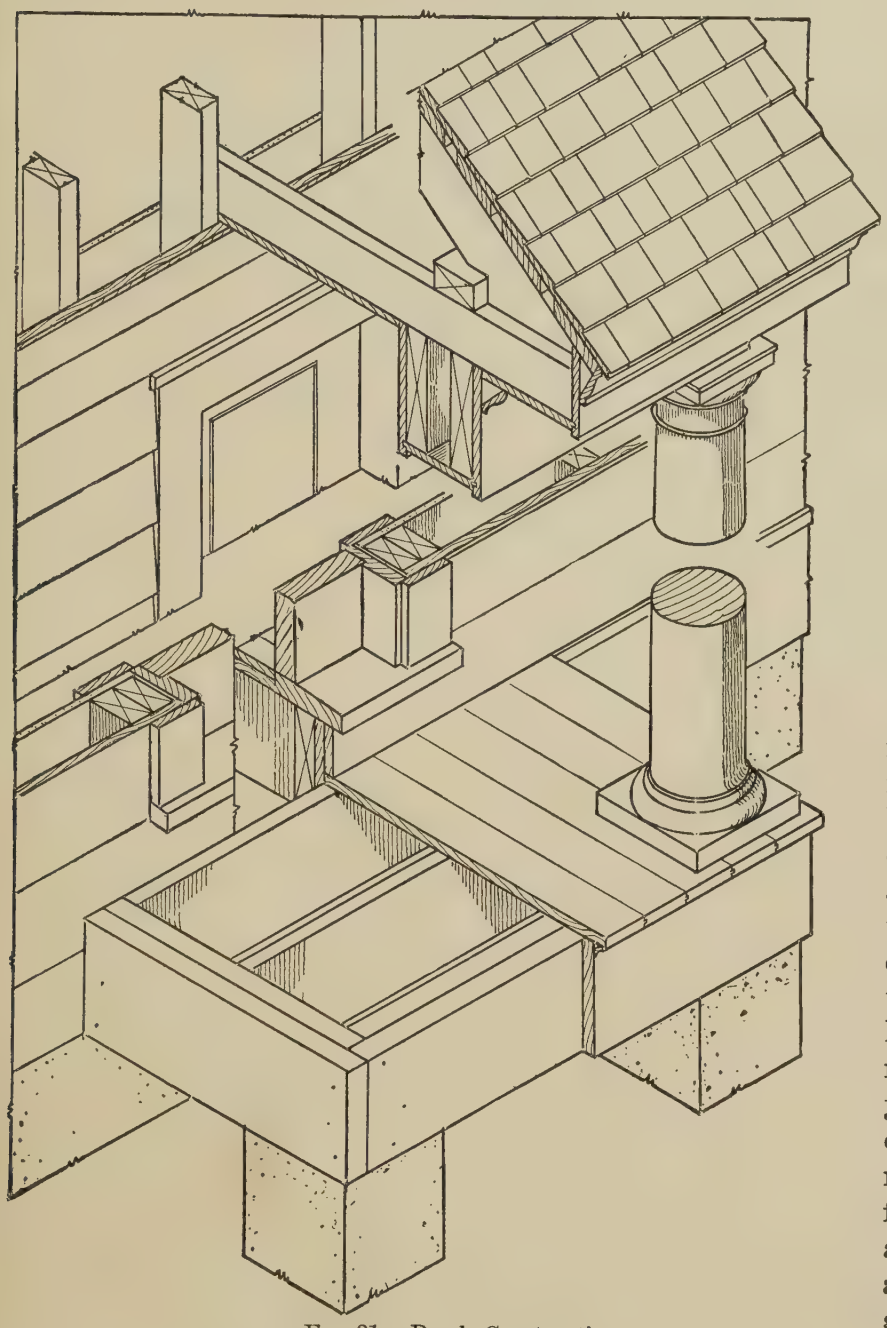


FIG. 31. Porch Construction

ing an air space of at least 1″ to prevent dampness.

50. Grounds are $\frac{13}{16}$″ in thickness by 1″ to 2″ in width and are nailed to the inside of the studs around all openings before the house is lathed. Their purpose is to afford a nailing for door and window casings and to give the plasterer a guide to which to level his plaster and thus insure a straight even wall.

51. Plastering. Most plastering is now put on with two-coat work. The first or base coat must be firmly pressed on, so the plaster will clinch back of the lath and thus form a *key*. This is allowed to partially dry and is then gone over with a float, which roughens the surface. It is then allowed to set and become thoroughly hard and dry. The thin skim or finish coat is then applied. The combined thickness of lath and plaster averages ¾″.

52. Door Frames and Trim. Door frames are made from 2″ stock and for outside doors, are rabbeted. The rabbet is ½″ deep and the same width as the door thickness. The total width of the frame depends on the design and the thickness of the wall. In a very thick wall, there may be a paneled subjamb. (Fig. 32.) In cheap construction, a ½″ *stop* may be nailed to a ⅞″ frame, or still better, is an adjustable stop with a ⅜″ lug fitting into a groove in the frame. The entire frame consists of two side jambs and the head, which is the same in section as the side. The trim around door openings is kept in harmony with that of the windows, the same casings and architrave being used both in the exterior and interior. The inside casing either rests on a *plinth block* the same height as the base or, if the frame has a back band, it is carried to the floor and the base stops against it.

53. Doors. Sizes of doors have already been given. (Art. 13, Fig. 32.) Interior doors are usually veneered. The veneer is glued to a built-up core for the stiles and rails, while the panels are two or three-ply veneer in thickness. (Fig. 33.)

54. Window Frames, Trim and Sash. There are various methods of constructing window frames. A typical stock frame is shown in Fig. 34. Plate 5 illustrates a very good type of double-hung window construc-

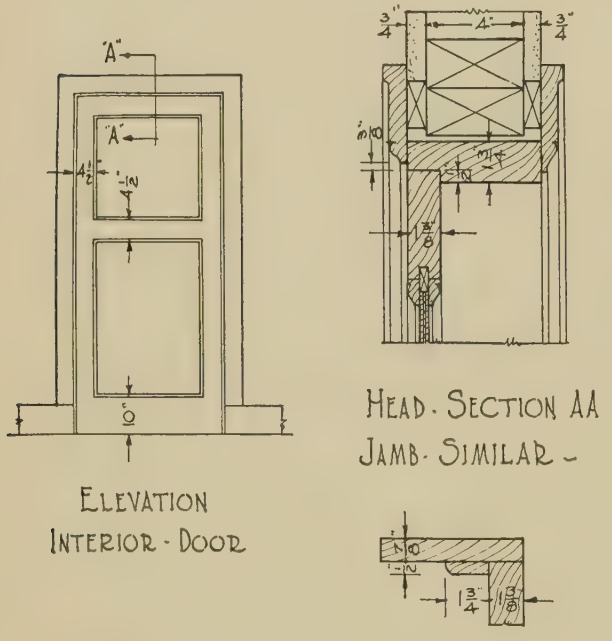


Fig. 32. Door Jamb

tion. The *pulley stile* and *yoke* are both rabbeted to the outside casing and to the ground casing. In a cheap frame, this ground casing is omitted. (See details of Prob. 7.) The parting strip is grooved 3/8″ into the pulley stile and the yoke. The sill should be given a pitch of 1″ to 8″. The space allowed for the weights is at least 2″ for the 1 3/8″ sash, and a minimum of 2 1/4″ for the 1 3/4″ sash. The frame used for masonry walls is called a box frame. A typical box frame is illustrated on Plate 45. Instead of an outside architrave, a staff or brick mould is used to cover the angle between the box frame and

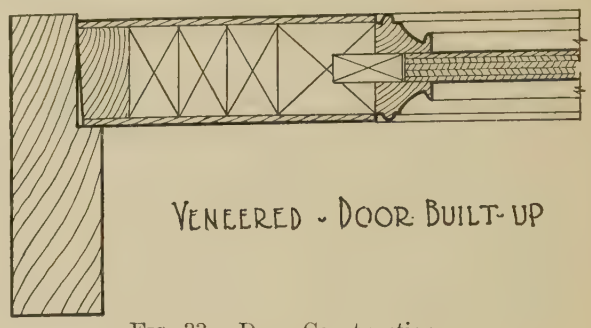


Fig. 33. Door Construction

the masonry. The masonry opening is figured 8″ wider than glass width, the weight box being recessed in the wall. Casement windows are of two types, in-swinging and out-swinging. The out-swinging has the advantage of being more weather tight,

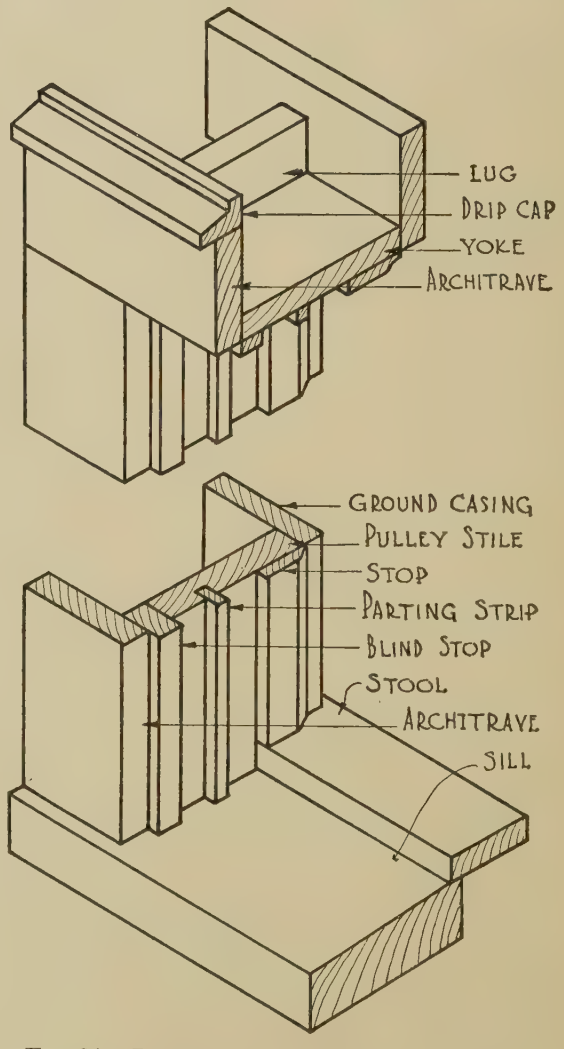


Fig. 34. Perspective of D. H. Window Frame

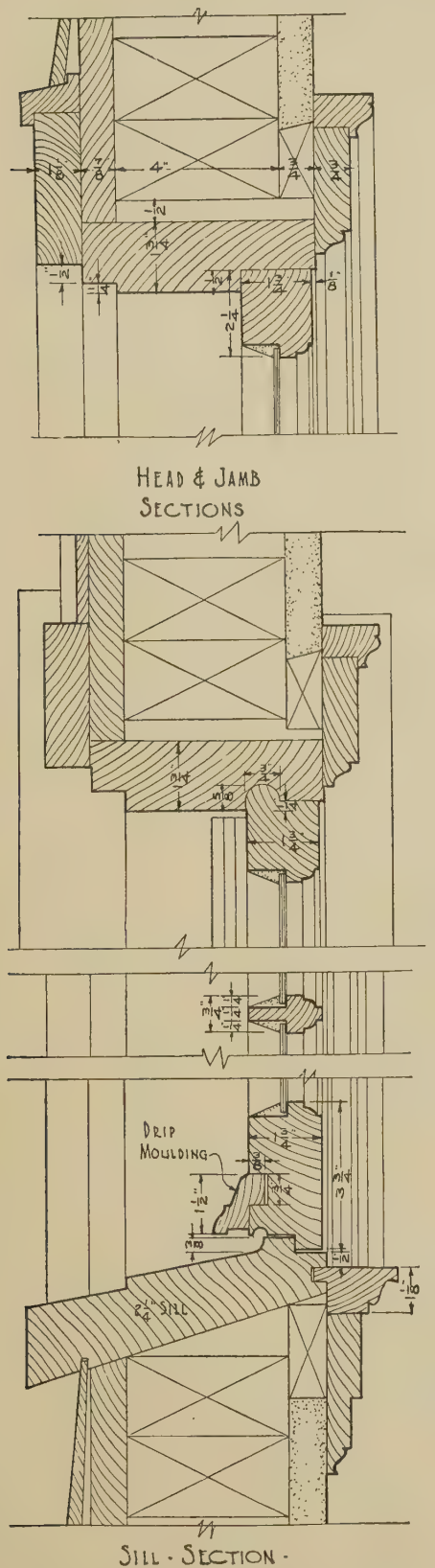


FIG. 35. Section of Casement Window

while the in-swinging (Fig. 35), is more easily operated and does not interfere with the screens. Pivoted windows and windows hung at the top, as basement windows (Fig. 36), are similar in construction to casements.

Mullions are the vertical members separating the sash in a group of windows. A typical double-hung window mullion is illustrated in Fig. 37.

The vertical members of the sash are called *stiles* and measure 2″ from the glass rabbet to the outside edge. The upper horizontal member is the top rail, also 2″ in width. The middle member is the *meeting rail* or *check rail,* which is 1″ from rabbet to rabbet. The lower rail measures 3″. The dividing strips of wood, breaking the glass up into smaller panes are called muntins. (Plate 5.) Glass comes in sheets of even inch sizes, and in double thickness or single thickness. Double thickness is ordinarily used and is about ⅛″ thick. A A is the best grade, A next.

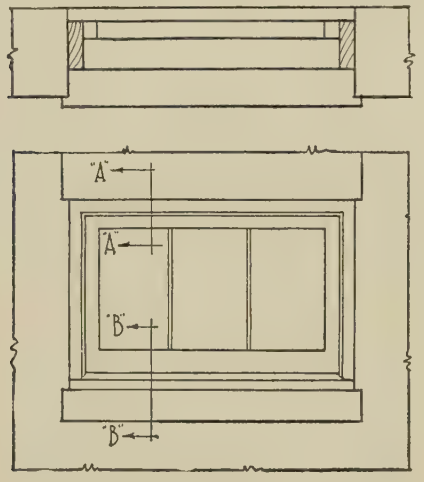
55. Stairs. Stairs may be classified according to construction, as the *open* and *closed* string. In the former type the ends of the risers and treads are exposed. (Plate 6.) The foundations of a flight of stairs are the carriages. They are made from 2″x12″s or 2″x10″s and cut to correspond to the risers and treads.

The risers are of ⅞″ material and the treads 1⅛″ in thickness. The best method of framing risers and treads is to rabbet both riser and tread. (Plate 6.) The nosing should project from 1″ to 1½″. The riser and tread are housed into the wall string and blocked in place with wedges.

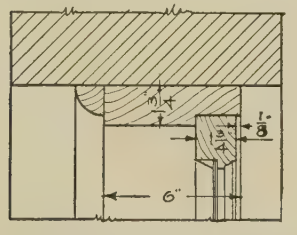
The *balusters* in the open string are either two or three to the tread, the outer one always being even with the outside face of the riser. In the closed string, they should all be of the same length and from 1″ to 1¾″ square, or turned. They are housed or doweled into the tread and hand-rail. The *hand-rail* varies much in design but should always be of such a shape and size, that the hand may grasp it comfortably. The newel or starting post may be built up and either paneled

or turned. The shape or style should be in general harmony with the rest of the interior trim.

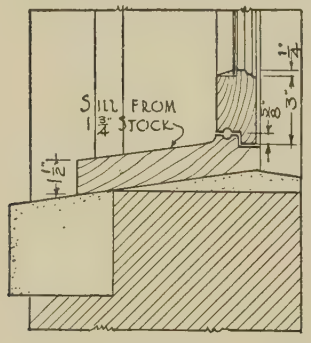
56. Flooring. Hardwood flooring comes either straight or quarter-sawed, the latter being much more desirable. Sizes vary. Oak flooring does not exceed a 2¼″ face and ranges in thickness from ⅜″, ½″ and ⅝″ to $\frac{13}{16}$″. Maple flooring comes in widths of from 1¼″ to 3¼″ face measurement. Rough flooring, which is laid under the finished flooring, averages $\frac{13}{16}$″x5⅝″ in size. (Art. 68.)



TYPICAL BASEMENT WINDOW
PLAN & ELEVATION FOR ¼" SCALE



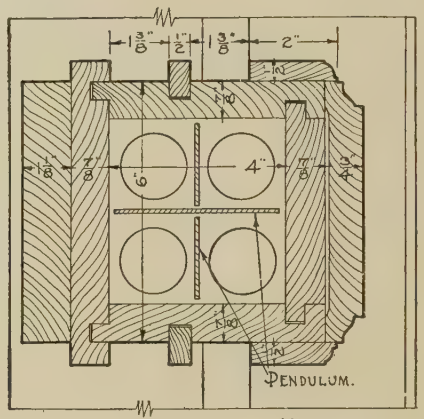
HEAD SECTION "A A" JAMB SIMILAR



SILL SECTION "B-B"

FIG. 36. Basement Window Detail

57. Built-in Equipment. Kitchen cases or cabinets are either flush or open, the open type being more used. It has an open space for a counter between the upper and lower section. (Plate 8.) The height of the counter or workshelf should be at least 2′ 8″, and the space between the counter and the upper section averages 16″. The total height varies according to the ceiling height. If the case should not extend to the ceiling, a



SECTION THROUGH MULLION.

FIG. 37. Mullion of D. H. Window

rounded top may be used instead of the prevalent mould as it is more sanitary and catches less dust. The doors should be 1⅛″ in thickness especially if glazed doors. The stiles are of a 2″ minimum width and the bottom rail varies from 2½″ to 3″. Glazed doors are used for china compartments and wood-paneled doors elsewhere. In average work, the frame of the case is the same thickness as the door, 1⅛″. In the better construction it is 1¼″. Stops for the doors are formed at the sides and top by a ½″ strip and at the bottom by a rabbet in the shelf. Doors should be made as dust proof as possible. Brackets are used under the upper section to support it and form a finish. Sides of the case should be paneled if exposed. The back is usually omitted. A good plaster finish is satisfactory

altho a back of wall-board or matched wood boards is sometimes used. The back of the working space should be lined with wood. The drawers should vary in size, the smaller ones for silver being at the top. They are either of the flush or lip types. The stock for the bottom is $\frac{3}{8}''$ or $\frac{1}{2}''$ in thickness. The method of framing the corners is by means of a rabbet or by dovetailing, the former method being most common. The shelves are made adjustable and of $\frac{7}{8}''$ material. Flour bins of large tilting variety are seldom used. The small metal bins similar to the ones used in manufactured cabinets can be obtained and are more satisfactory.

Linen closets are more satisfactory when arranged with doors opening full width and with shelves only. These should be at least 2′ 0″ in depth.

Medicine cases may be obtained in almost any size desired. The metal ones with glass shelves are more sanitary than those of wood construction. They may be easily recessed in the wall.

CHAPTER IV

Masonry Construction

58. Foundations. The foundation walls for houses may be of concrete, brick, hollow tile or stone. The minimum thickness of concrete walls for small houses is 8″. A 10″ or 12″ thickness is better practice. When brick is used, 9″ is a minimum thickness. A stone or rubble foundation will run from 18″ to 24″. The thickness is determined largely by the load to be supported and by the depth of the wall. A *footing* to distribute the load carried down by the wall is practically always necessary. It should be at least 6″ to 8″ wider than the foundation wall and 8″ to 12″ in depth. The basement floor, which is of 4″ concrete, is carried just above the footing. In a damp location the outside of the foundation wall should be thoroly protected by a coat of asphaltum or tar or tarred felt applied while hot. (See design of footing, Art. 69.)

59. Brick Construction. Building bricks are made of a mixture of clay and sand which is subjected to various processes, differing according to the nature of the materials, the method of manufacture, and the character of the finished product. After the materials are mixed they are moulded, dried and burned. Oxide of iron gives brick their characteristic color. *Face brick,* as distinguished from common brick, are brick especially selected for their color, surface texture and uniformity of size. Salmon brick is light yellow in color and is underburned, while the opposite extreme is found in *paving brick,* which is burned hard or vitrified and is bluish black in color. The standard size of brick adopted by the Common Brick Manufacturers Association and the American Institute of Architects is 2¼″x3¾″x8″. Brick joints may be classified as *struck* joints, *weather, raked, concave* and *flush.* Their thicknesses vary from $\frac{3}{16}$″ to ½″, ¼″ being the average altho the ⅜″ joints are used extensively in face brick work.

60. Bond. Bond in brickwork has reference to arrangement of the bricks for the purpose of tying the wall together and distributing the load over a greater area. The typical bonds are the *common* or running, *Flemish, English* and the *English cross* bond. (Fig. 38.) The common bond consists of a course of headers to every sixth course of stretchers. A *stretcher* is the long face of the brick. A *header* is the narrow end. A *soldier* course is a course of bricks placed on end the long way. A rowlock course is a course placed the narrow way on edge. The Flemish bond consists of alternate headers and stretchers in each course, the header centering on the stretcher in successive courses. The English bond is made up of alternate course of headers and stretchers. The English cross bond breaks joints in each successive stretcher course so that the header centers on the stretcher above and below.

61. Brick Veneer. In brick veneer construction the usual wood frame work is put up as in any entirely frame house. The sheathing should be covered with building paper secured by 1″x⅝″ furring strips. An air space of 1″ is left between the sheathing and the single layer of brick, which is tied to the wood by means of corrugated metal ties placed one over each stud and spaced every fourth or fifth course vertically. (Plate 46.)

62. Anchoring. The rafter plate or wall plate should always be anchored to a masonry wall by ½″ tie rods or bolts, 12″ to 16″ long with a flat plate 3″x3″x¼″ at the lower end. (Plate 45.) These tie rods should be spaced not more than 5′ apart. Joists are anchored to brick walls either by iron anchors attached close to the lower edge of the joist or by joist wall hangers or metal stirrups built in the wall. *Corbelling* is the stepping out or projecting successive courses beyond each other to form a support for timbers. (Plate 46.)

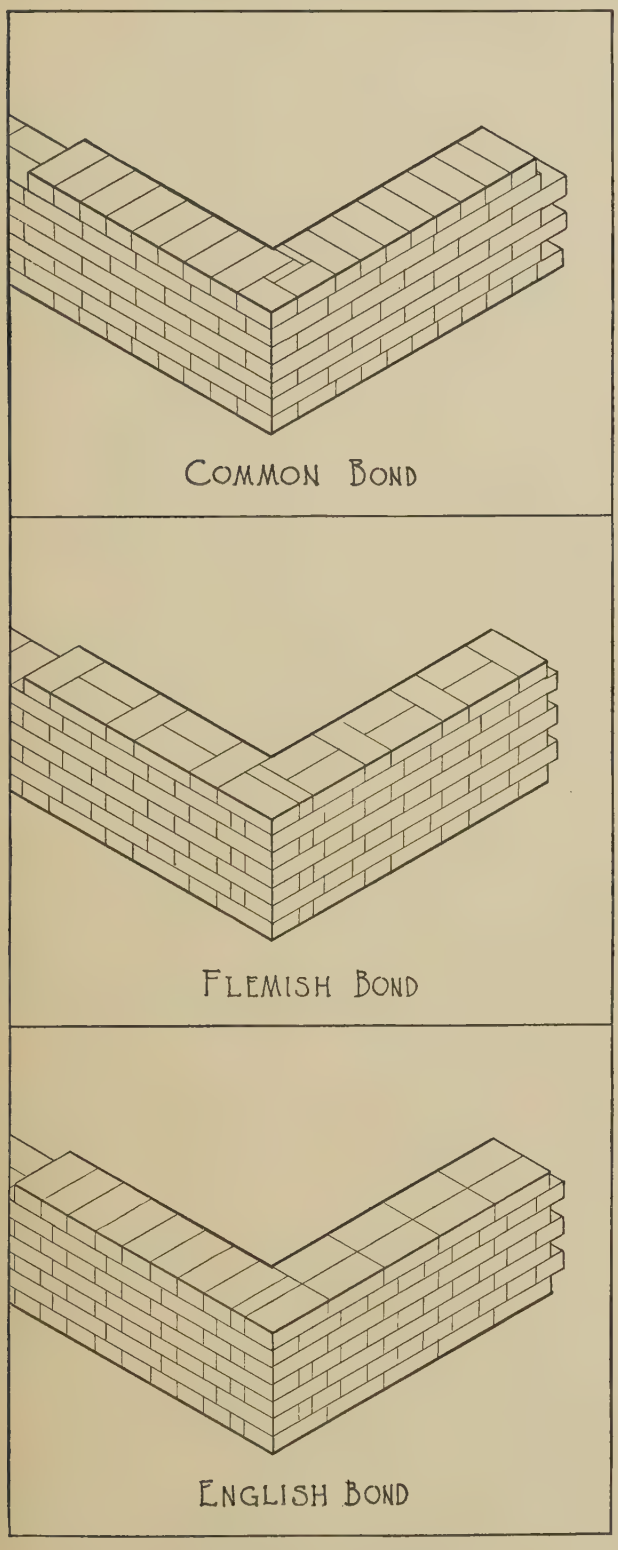


FIG. 38. Bond in Brick Work

63. Doors and Windows. The design and construction of door and window frames for masonry walls has been taken up in previous paragraphs. Underneath the window sill in a brick wall it is necessary to place a brick or stone sill. If brick are used, they are placed on edge and pitched about 1″ in 6″. (Plate 45.) The masonry opening itself will run 8″ wider and 10″ higher than glass size. For example, a two-light 30″x26″ window, will require a 34″x58″ sash or a 3′ 2″x5′ 2″ masonry opening. For doors the openings are 4″ wider and 2¾″ higher than the door. For example, a 3′x7′ door requires an opening 3′ 4″x7′ 2¾″. Brick work over all openings must be supported. This is accomplished by steel or wood *lintels* or by brick arches. When a steel angle beam or brick arch supports the face brick, the common brick backing usually rests on a wooden lintel set higher than the arch or concealed by the frame, or a relieving arch may be placed above the wood lintel to assist in carrying the load. For a brick veneer wall with a flat arch a single steel angle beam is used over the opening, but for a solid brick wall two angles are used, placed back to back. (Plate 46.) For openings up to 3′ 0″ a 3′x 3′x¼″ angle beam is sufficient; for larger openings up to 5′ or 6′ a 3″x5″x¼″ may be used. The angle beams should have a bearing surface of at least 4″ on either side of the opening. The amount of load transmitted to a lintel is the weight of the brick inclosed in an equilateral triangle the base of which is the width of the opening.

64. Brick Arches. The full semicircular or segmental arch is usually self-supporting. Flat brick arches are supported by lintels. (Fig. 39.)

65. Fireplaces. As previously stated the proportions of all parts of a fireplace depend largely on the size of the fireplace opening. The splayed sides of the fireplace are from a 2″ to 5″ slope per foot of depth. The back wall should be curved or pitched toward the front, throwing the smoke of the fire forward to the throat, whose area should be $\frac{1}{12}$ that of the fireplace opening, and width from 3″ to 4½″ average. A metal damper is very desirable in controlling the draft. (Plate 7.)

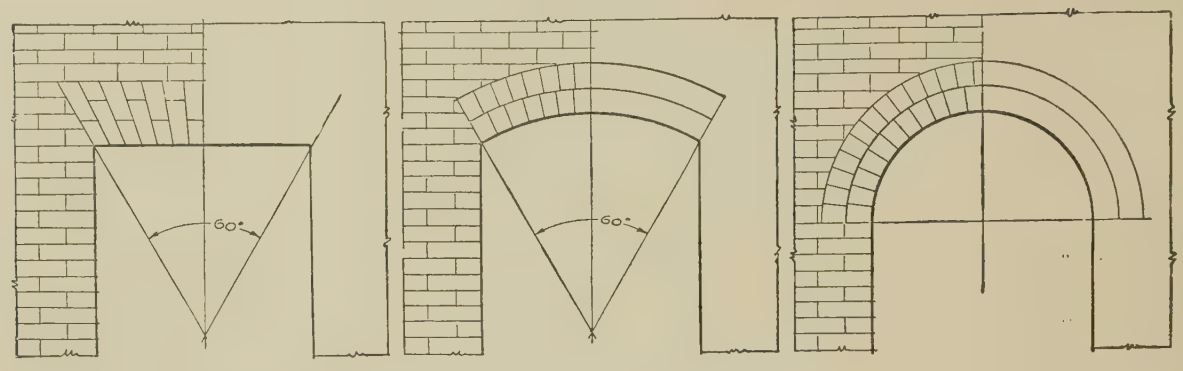


FIG. 39. Brick Arches

Directly above the throat is the *smoke chamber*. This space is about the same depth as the flue and tapers at an angle of 60° from the width of the throat opening at the bottom to the width of the flue at the top. (Fig. 40.) It should be perfectly smooth. A back draft or smoke shelf just back of the *throat* is necessary and prevents down drafts from blowing smoke and ashes into the room. The *flue* should center, when possible, over the fireplace and should be $\frac{1}{10}$ the area of the opening. Terra cotta flue linings are commonly used. They start at the top of the smoke chamber and carry up to 1″ above the chimney cap. Common stock sizes of the tile flues are:

Outside, 8½″x 8½″....Inside, 7¼″x 7¼″
Outside, 8½″x13″ ....Inside, 7″ x11½″
Outside, 13″ x13″ ....Inside, 11⅜″x11⅜″

Chimneys should be carried at least 2′ 0″ above the highest point of the roof. The top of the chimney may be finished by means of a plain cement cap sloped from the edge of the flue tile to the inside brick edge. Ornamental chimney pots may be used. (Fig. 14.) The cheaper chimneys are made up of one thickness of brick with tile flue lining. Exposed walls of chimneys should be 8″ in thickness to prevent cooling of smoke. The *hearth* is the floor of the fireplace on which the fire is built. The portion in front of the facing which projects out 12″ to 18″ is built over a trimmer arch. This is usually made

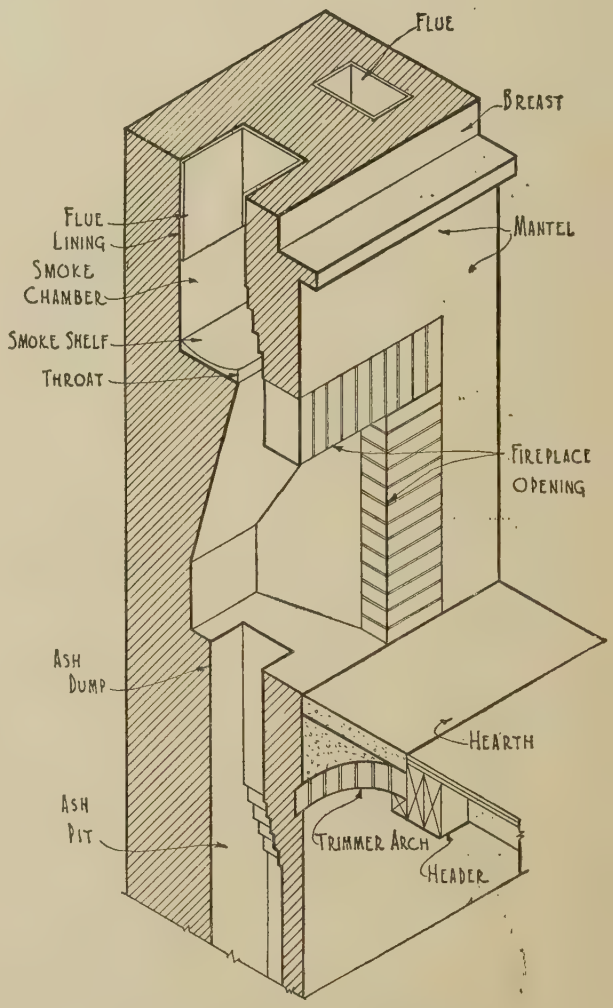


FIG. 40. Perspective of Fireplace

of brick, altho sometimes a reinforced concrete slab is used. On top of this is a cement bed to take the hearth tile or brick, as the case

may be. The ash dump is set about 4″ out from the back of the fireplace; it comes in average stock sizes of 5″x7″ or 6″x8″. The facing of the typical fireplace is either of tapestry brick or face brick with a wood or brick mantel shelf above. Many interesting designs may be worked out in brick. Over the opening a flat arch may be used supported by an iron bar or it may be segmental or semicircular arch and be self-supporting.

The Colonial style fireplace demands a wood facing or mantel. This must be set back from the opening at least 6″ at the sides and 8″ over the top. The foundations should be carried down to the same depth as those of the house, or below first level, and should be large enough to distribute the weight over the soil according to its bearing capacity. A hollow space is left at the bottom for the ash pit into which the ash dump from above opens. Sizes of cast iron clean-out doors are 8″x10″, 10″x12″ and 12″x14″.

66. Hollow Tile Construction. Hollow tile is a fireproof product of burned clay and shale. It is made in the form of hollow blocks with webs or partitions dividing the block into cells. The exterior surface is scored or grooved to afford a key for plaster or stucco. The blocks come in various sizes, the most common being the 5″x8″x12″, 8″x12″x12″ and 4″x12″x12″. They may be laid on the ends or on the sides, either method giving practically the same ultimate strength. Special tiles are used around door and window openings. The allowance for width and height and the construction of doors and windows for hollow tile is practically the same as for brick construction. Hollow tile may be stuccoed or faced with brick veneer.

67. Concrete Block, or Manufactured Stone. This product when properly made is a superior building material. Unfortunately the general run of concrete blocks are poorly made and are thoroly ugly in their imitation of stone, especially the so-called "rock face" blocks. The good concrete block has a plain surface, which is left as rough as the facing aggregate permits. The granite face blocks, made with granite flakes or chips of various colors and afterwards washed with muriatic acid, rivals in beauty the natural stone and is more durable. Blocks are made in various sizes and shapes, depending on the moulds. The most common are 8″ to 12″ thick, 8″ to 12″ high and 16″ to 24″ long.

CHAPTER V

Stock Sizes—Strength of Material—Designing Data

68. Stock Sizes. Practically all lumber is cut and sold in even lengths; as 12′, 14′, 16′, etc. Timbers may overrun such lengths slightly but this cannot be counted on. Any odd or fractional lengths required in a building must be purchased at the next higher even length. Therefore a careful study of the size of a building, the arrangement of rooms, supporting walls and girders, posts, story heights, etc., may result in considerable saving by eliminating the cutting of lengths slightly under standard sizes. The nominal sizes of lumber also differ from actual sizes as shown in the following. Stock sized on one side and one edge (S1S1E) means it is surfaced or planed on one side and one edge only; S4S means surfaced on all four sides.

Nominal	*Actual*
2″x 4″	1⅝″x 3⅝″
2″x 6″	1⅝″x 5⅝″
2″x 8″	1⅝″x 7½″
2″x10″	1⅝″x 9½″
2″x12″	1⅝″x11½″
4″x 4″	3½″x 3½″
6″x 6″	5½″x 5½″
8″x 8″	7½″x 7½″

One inch rough flooring or boards, S1S or 2S is $\frac{13}{16}$″ thick and 3⅝″, 5⅝″ and 7⅝″, etc. in width.

Shiplap, 8″, 10″ and 12″ widths is worked to ¾″x7⅛″, 9⅛″ or 11⅛″ face, the lap being ⅜″.

Bevel siding is made from stock S4S, and worked to $\frac{13}{16}$″x3½″ or 5½″ and resawed on a bevel (Plate 3), making the thin edge $\frac{3}{16}$″ thick and the thick edge ⅝″. Standard lengths come in multiples of 1′ 0″.

Colonial or Wide Siding comes in nominal sizes of 1″x8″, 1″x10″ and 1″x12″; finished widths of 7¼″, 9¼″ and 11¼″, thickness at thin edge ¼″, at the thick edge $\frac{11}{16}$″.

Drop Siding—D and M (dressed and matched) is ¾″x3¼″ or 5¼″ face or 3½″ and 5½″ over all.

Finished Flooring 1″x3″, 4″ and 6″ is finished to $\frac{13}{16}$″x2¼″, 3¼″; and 5¼″ face measure, ½″ being taken up by the tongue. Hardwood flooring may be obtained in thickness of ⅜″, ½″ and ⅝″.

Finished ceiling comes in thickness of $\frac{5}{16}$″, $\frac{7}{16}$″, $\frac{9}{16}$″, and $\frac{11}{16}$″, with same face widths as flooring.

69. Strength of Joists, Rafters, Girders, and Posts. Even in designing simple frame construction, one should have some knowledge of the strength of timbers employed and the amount of load they will carry safely. In computing the size of joists, having given the span and the spacing on centers, we must first determine the loads. Joists usually carry a uniform load composed of the weight of the joists themselves plus the flooring, plus the ceiling, plus the superimposed loads of people, furniture, etc. The latter loads are called live loads, in contrast with the constant loads due to the weight of the floor construction itself, called dead loads. The joists are supported at their ends by girders, bearing partitions or bearing walls. They often carry concentrated loads in addition to the uniform loads mentioned above.

Concentrated loads are caused by especially heavy articles of furniture such as safes and pianos or by cross partitions resting on the floor. A simple way to design a beam for a concentrated load is to find its equivalent value in an uniformly distributed load; for example a concentrated load at the center of a beam is equal to twice a similar load uniformly distributed. At ⅓ the span it is equivalent to 1¾ times and at ¼ the span 1½ times a similar distributed load. In other words the beam or joist must be made 2 or 1¾ or 1½ times as strong, as the case may be, to carry the same load concentrated as it would be to carry the identical load uniformly distributed.

We will assume, for example, a span of 15′ 0″ in a house. What size joists must be used spaced 16″ on centers? (Fig. 41.) Each joist will support a floor area of 15′x1⅓′ or 20 square feet. We will assume that this joist will probably be a 2″x10″, which will weigh about 3¾ pounds per square foot floor area when spaced 16″ o.c. The plastered ceiling weighs about 10 lbs. per square foot

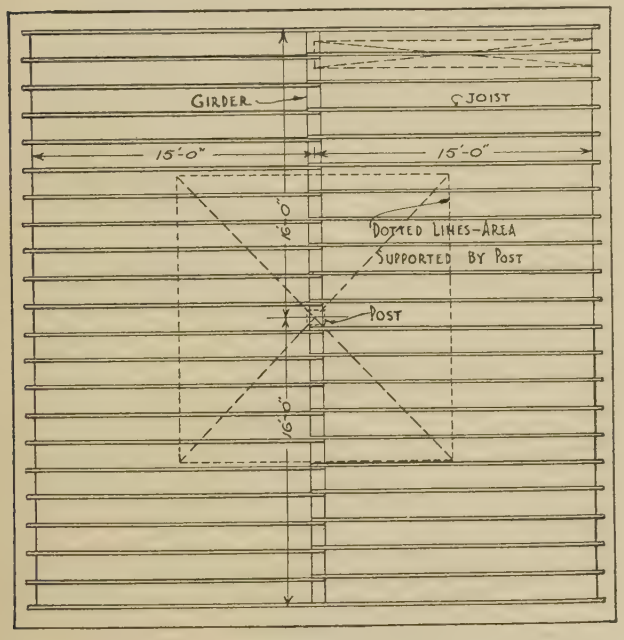


Fig. 41. Loads on Joists, Girders, Columns

and the flooring 6 lbs., making a total dead load of 19¾ lbs. per square foot. The live load according to the average city ordinance is 40 lbs. per square foot, making a total live and dead load of 59¾ lbs. Then, multiplying 59¾ by 20, the square foot area, we have 1195 lbs., total load for the joist. Referring to Table I, Page 57, we find that a 2″x10″ yellow pine joist will carry about 1900 lbs. for a 15′ span which is more than strong enough for our load. However, this additional strength is desirable, especially if there is a plastered ceiling, as too great a deflection, or bending of the joist will cause the plaster to crack.

In calculating the size of girder required to carry the floor joists, we may consider the loads transmitted by the joists, as being uniformly distributed. For example, we will consider the girder as having a 16′ span between supports. It will carry half the loads of the floor joists on either side, making a panel area of 16′x15′ or 240 square feet. Multiplying this by the load of 59¾ lbs. per square foot, we find the total to be 14,340 lbs. Referring to the table, we find that a 2x14 Y. P. beam will carry 3702 lbs. for a 16′ span, or four 2x14's will carry 14,808 lbs. which, with our factor of safety will be sufficiently strong. If a steel I-beam is preferred in place of the wood girder, refer to Reference Books, either Nos. 9, 11, 12, page 127, and it will be found that a standard 9″ steel I-beam weighing 25 lbs. to the foot will carry 13,620 lbs. for a span of 16′ 0″ or a 10″ I-beam weighing 25 lbs. will carry 16,280 lbs. The latter may be used, since its weight is the same as the former and it has the advantage of additional stiffness and strength at the same cost, as steel is sold by the pound. The weight of the girder itself should be considered in the total load. The live load for girders may be taken as 80 per cent of the live load for the joists, as there will always be some portion of the floor supported by the girder not loaded, or at least not up to the assumed load. Therefore, our factor of safety is greatly increased.

In ordinary construction, the girder, instead of having a 16′ clear span, would probably be supported at the center by a wood post or small cast-iron column, thus making use of a smaller girder.

For calculating the size of the columns or supports for carrying the load transmitted by the girder, we must first take the floor area carried by the column. In this case it is 15′ 6″x16′ 0″ or the same as that carried by the girder, which was 14,340 lbs. plus the weight of the girder, about 416 lbs., making a total load of 14,856 lbs. Assuming the height of the column to be 8′, we find, upon referring to Table II, that a 6″x6″ post will carry 12.65 tons, far more than is necessary for safety; also a 3″ gas pipe column 8′ high will carry 18,280 lbs. (Table III.)

Now, having carried the load to the base of the column, we must determine what the area of the footing must be to prevent settling. We will assume the bearing soil to be clay, which will bear from 1 to 4 tons per square foot; taking 2 tons as an average, we divide the total load of 14,856 lbs. by 4000 lbs., giving 3.71 square feet or the footing should be approximately 24″x24″ under the column.

Table I is the safe load in pounds uniformly distributed for yellow pine beams supported at both ends, based upon an extreme fiber stress of 1800 pounds per square inch and a horizontal shearing stress of 175 pounds per square inch. A factor of safety of 4 is allowed, which means that it may be possible to increase the loads to four times those given in the table before actual failure takes place. Safe loads for other factors of safety may be obtained as follows:

New safe load = Safe load from table × 4 ÷ new factor.

The table is compiled from the *Southern Pine Manual of Standard Wood Construction,* which recommends that the given fiber stress should be the maximum that may be safely used.

In cities, the lawful working stresses are either definitely stated or are specified according to the recommendations of the American Railway Engineering Association. In the event that these fiber stresses are less than the maximum 1800 pounds, the following conversion factors may be used:

f=Extreme fiber stress in pounds per square inch.
When f=1000—Given load × 1.8 =New load.
When f=1200—Given load × 1.5 =New load.
When f=1300—Given load × 1.4 =New load.
When f=1400—Given load × 1.3 =New load.
When f=1500—Given load × 1.2 =New load.
When f=1600—Given load × 1.13=New load.
When f=1700—Given load × 1.06=New load.

The new load may then be found in the table opposite the given span, and at the head of the column will be found the required size of the beam.

Lawful fiber stresses for yellow pine beams, according to the building codes of various cities are as follows:

Albany—1200 pounds.
New York—1600 pounds.
Milwaukee—1800 pounds (long leaf).
Milwaukee—1500 pounds (short leaf).
Detroit—1250 pounds.
New Orleans—1500 pounds (long leaf).
New Orleans—1200 pounds (short leaf).
Chicago—1300 pounds (long leaf).
Chicago—1000 pounds (short leaf).
Philadelphia—1600 pounds.

The American Railway Engineering Association recommends 1300 pounds for long leaf yellow pine, and 1100 pounds for short leaf yellow pine. These stresses may be increased 50 per cent for the best grade of structural timber used in ordinary buildings and protected from the weather.

Southern yellow pine is the wood most commonly used for framing and is, therefore, the one that has been chosen for the table. If other woods are used, the size of the timbers should be decreased according to their unit stresses.

Designing Data

TABLE I

SAFE LOAD IN POUNDS UNIFORMLY DISTRIBUTED FOR Y. P. (YELLOW PINE) BEAMS SUPPORTED AT BOTH ENDS

Fiber stress, 1,800 pounds per square inch. Factor of safety of 4

Span in Feet	*Size of Beam*				
	1⅝"x5⅝" 2x6	1⅝"x7½" 2x8	1⅝"x9½" 2x10	1⅝"x11½" 2x12	1⅝"x13½" 2x14
6	1714	3047	4488	7163	9872
8	1285*	2285	3666	5372	7404
10	1028	1828	2933	4298	5923
12	857	1523	2444	3582	4936
14	734	1306	2095	3070	4231
16	642	1142	1833	2686	3702
18		1016	1629	2388	3291
20		914	1466	2149	2961
22			1333	1954	2692
24			1222	1791	2469

**Note:* Loads below black lines are for strength and should not be used on plastered ceilings as they permit more than $\frac{1}{30}$ of an inch deflection per foot of span.

TABLE II

WOOD COLUMNS

Safe loads for wood columns based on a compressive strength of 1,100 lbs. per square inch, parallel with the grain.

Nominal Size in Inches	*Actual Size in Inches*	*Length in Feet*	*Safe Load in Tons*
6x6	5½x5½	8	12.65
6x6	5½x5½	10	11.37
6x6	5½x5½	12	10.22
6x6	5½x5½	14	9.23
8x8	7½x7½	8	26.13
8x8	7½x7½	10	24.32
8x8	7½x7½	12	22.52
8x8	7½x7½	14	20.84
8x8	7½x7½	16	19.27

TABLE III

GAS PIPE COLUMNS

Nominal Size in inches	*External Diameter*	*Safe Load in Pounds*			*Length in Feet*
		8	10	12	14
1¼	1.66	3,740			
2	2.375	8,591	7,193		
3	3.5	18,280	16,700	15,040	
4	4.5	28,900	27,300	25,440	23,560
5	5.56	37,520	36,520	34,620	32,520

Safe loads for "Lally," "Crex," and other patent columns may be obtained from *Sweet's Catalog,* or manufacturers' literature.

TABLE IV

SAFE MAXIMUM SPAN FOR JOISTS

Total load 60 pounds

Sizes of Joists	*Norway Pine or Spruce*	*Long Leaf Yellow Pine*
2x 6—16″ O. C.	9′ 6″	10′ 6″
2x 6—12″ O. C.	10′ 5″	11′ 7″
2x 8—16″ O. C.	12′ 8″	14′ 1″
2x 8—12″ O. C.	13′ 11″	15′ 6″
2x10—16″ O. C.	15′ 9″	17′ 7″
2x10—12″ O. C.	17′ 5″	19′ 4″
2x12—16″ O. C.	18′ 4″	20′ 6″
2x12—12″ O. C.	20′ 3″	22′ 6″

TABLE V

SAFE MAXIMUM SPAN FOR RAFTERS FOR SHINGLED ROOFS

Total load of 48 pounds per square foot of which 20 pounds is estimated snow load

Sizes of Rafters	*Norway Pine or Spruce*	*Long Leaf Yellow Pine*
2x 4—16″ O. C.	8′ 4″	10′ 10″
2x 4—20″ O. C.	7′ 6″	8′ 10″
2x 6—16″ O. C.	12′ 6″	15′ 0″
2x 6—20″ O. C.	11′ 2″	13′ 4″
2x 8—16″ O. C.	16′ 8″	20′ 0″
2x 8—20″ O. C.	14′ 11″	17′ 10″
2x10—16″ O. C.	20′ 10″	25′ 0″
2x10—20″ O. C.	18′ 8″	22′ 3″

TABLE VI

CEILING JOISTS

Total load 20 pounds per square foot

Size	*Norway Pine and Spruce*	*Long Leaf Yellow Pine*
2x4—12″	10′ 1″	11′ 2″
2x4—16″	9′ 1″	10′ 1″
2x6—12″	15′ 1″	16′ 8″
2x6—16″	13′ 8″	15′ 2″
2x8—12″	20′ 1″	22′ 4″
2x8—16″	18′ 4″	20′ 5″

TABLE VII

WEIGHTS OF BUILDING MATERIALS IN POUNDS PER SQUARE FOOT

Yellow pine sheathing	2¾	Composition roofing	9
Yellow pine flooring	2¾	Slate $\frac{3}{16}$" thick	7
Wood shingles	2 to 2½	Tile—flat	15
Painted tin	2	Tile—Spanish	9
Sheet metal	3	Tile—Ludowici	8
Corrugated sheet metal	4	Lath and plastering	10

TABLE VIII

WEIGHT OF YELLOW PINE JOISTS IN POUNDS PER LINEAL FOOT

(O. C. = on center, that is, measured from center to center)

2"x 4"—16" O. C.—1.22	2"x 6"—16" O. C.—1.89
2"x 8"—16" O. C.—2.53	2"x10"—16" O. C.—3.21
2"x12"—16" O. C.—3.88	

TABLE IX

WEIGHT AND STRENGTH OF STUD PARTITIONS

This table gives the weight and strength per lineal foot of the partition in plan. The weight includes a single top and bottom plate, but does not include the weight of the lath and plaster or other wall covering, which should be added. The safe load assumes the partition to be bridged half-way up.

Size	*Spacing*	*Height*	*Safe Load*	*Weight*
2"x4"	16" O. C.	8' 0"	2793	13.04
2"x4"	16" O. C.	10' 0"	2385	15.5
2"x6"	16" O. C.	8' 0"	4326	20.24
2"x6"	16" O. C.	10' 0"	3699	24.03

TABLE X

WEIGHT OF BUILDING MATERIAL PER CUBIC FOOT

Brick—Common	125 pounds
Brick—Pressed	135 pounds
Brick—Paving	150 pounds
Concrete—Stone	145 pounds
Concrete—Cinder	105 pounds
Limestone—Masonry	162 pounds
Earth—Common loam (average)	90 pounds

SAFE ALLOWABLE LOAD FOR FOUNDATION BEDS

Rock—15 to 30 tons per square foot.

Sand or Gravel—2 to 5 tons per square foot.

Hard Pan—5 to 10 tons per square foot.

Clay—1 to 4 tons per square foot.

PROPORTIONS OF GUTTERS AND DOWN SPOUTS

A 3″ circular down spout may be used for a 3½″ gutter 12′ to 20′ long, or a 1¾″x4¼″ rectangular down spout for a 4″ gutter 22′ to 30′ long. A 4″ circular down spout will drain a 5″ gutter 35′ to 45′ long.

HEADER SIZES (MANSFIELD CODE)
(DOUBLE PLANKS W/ 1/2 3/8 SPACER BETWEEN)

2x6 FOR OPENINGS TO 4'0"
2x8 " " " 7'4"
2x10 " " " 10'8"
2x12 " " " 14'0"
2x12+2x6 " " " 16'0"

PROBLEMS

Group 1

The problems comprising Group 1 are shelters and one-room structures illustrating the simplest types and principles of construction.

70. Method of Procedure. In all of the elementary problems as well as those of a more advanced nature, it is necessary to follow a definite order of procedure.

Like a composition or a theme in music or in literature, an outline must first be made in order to grasp all of the features of the problem in a broad way. We cannot write an unrelated paragraph without first considering its relation to the theme as a whole. Neither can a part or detail of a building be drawn until the main outlines and general proportions are blocked in. This method when followed out not only makes for accuracy in execution but speed will be gained and much time saved.

Lay-outs in progressive stages are given for problems 1 and 5. The steps there illustrated will apply with modifications to all the problems following.

(1) Lay out the border line (Fig. 42). The border line for this and following problems is 13½″x18″. Half of an "imperial" sheet should be used. (An imperial sheet is 22″x30″.) The problems may, however, be readily adapted to other border-line sizes.

(2) Draw center lines for the plan, front and side elevations according to measurements in the circles (Plate 10). These dimensions are to be omitted on the finished drawing.

(3) Draw main horizontal lines starting with the ground lines and laying off heights of column and plate, width of well platform and center lines of columns. (Fig. 43.)

(4) Draw widths of columns in plan, projecting lines to the elevation. (Fig. 44.)

(5) Since the section gives us the location of the cornice, next center the 2″x4″ plate on column center line.

(6) Locate the rafters, the position of which are determined by the pitch of the roof. (Arts. 24 and 40 and Fig. 12.) To find the

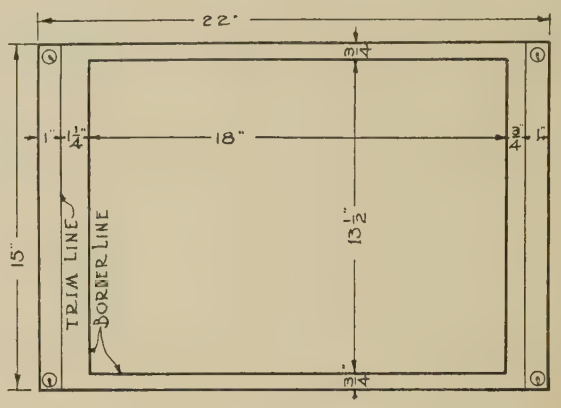


FIG. 42

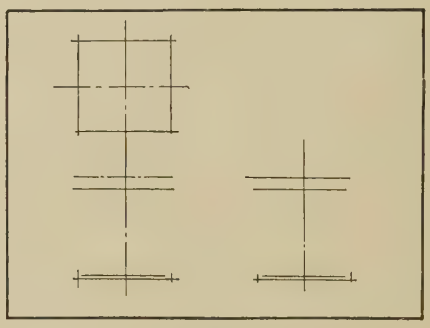


FIG 43

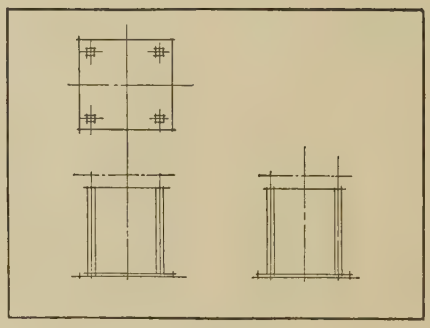


FIG. 44

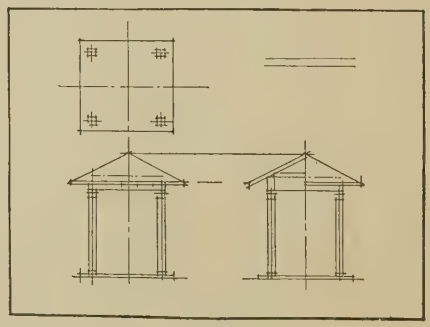


FIG. 45

pitch take ¼ the distance between the outside faces of the plate and lay off this measurement vertically on the center line of the roof; this point when connected with the outside corners of the plate will give the correct angle or pitch. A second method is to lay off a triangle having one corner even with the outside upper face of the plate, with a run of 12″ and a rise of 6″. The hypotenuse of the triangle will then be the slope of the rafter.

(7) At right angles to this slope measure off 2½″ giving the upper edge of the rafter.

(8) Draw bottom of rafter measuring back 4″ from this line.

(9) Draw line for roof boards 1″ from and parallel to the upper edge of the rafters.

(10) Draw line representing the shingles parallel to and 1″ away from roof boards.

(11) Lay out rafter and cornice projection. (See detail, also Art. 45 and Plate 4.)

(12) Project cornice lines across from section to elevation, making projection and profile the same as the section.

(13) Complete by drawing caps and bases of columns in detail.

71. Dimensioning and Lettering. (1) Dimension to centers whenever possible, for example, from center to center of columns. (Art. 4 and Fig. 7.)

(2) Dimension all main heights taking measurements from structural members and not from the trim or finish.

In architectural work, the type of letter, its size, position and spacing, also the position and spacing of titles and notes on a sheet is largely a matter of choice and design on the draftsman's part. A suggested title strip is shown in Problem 5. As shown in Problem 1 the title is centered in the upper right-hand space of the sheet. Height of letter, $\frac{5}{16}$″, capital, ⅜″; sub-title, $\frac{3}{16}$″; capital ¼″; notes $\frac{3}{32}$″. (Plate 10 and Art. 4.)

72. Inking or Tracing. (1) Use a heavy line for all outlines or silhouettes of drawings.

(2) Use medium-weight line for all main lines.

(3) Use light lines for center lines, dimension lines, and fine moulding, panel or muntin lines.

(4) Shingles are represented by very light horizontal lines in diluted ink.

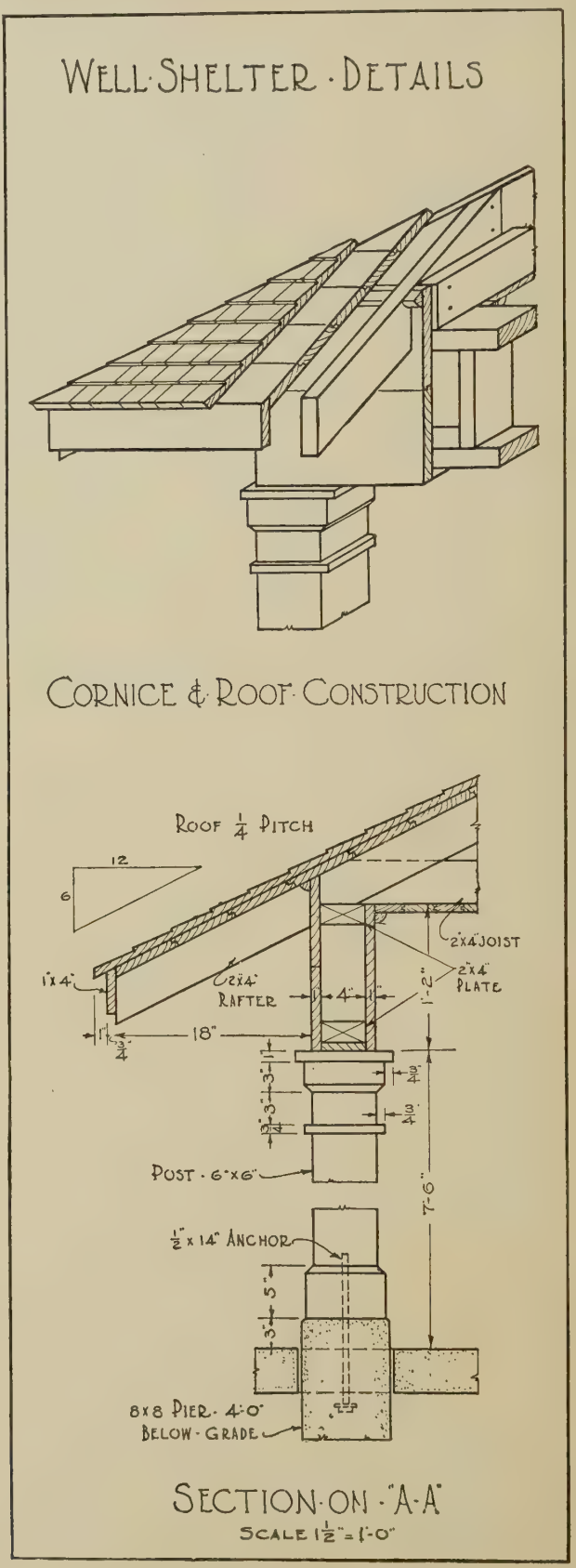
PROBLEM 1—**WELL SHELTER**

(PLATE 10)

Given: Complete plan, front elevation, half section and a partial half elevation.

Required: Draw views as shown, completing the part elevation, same as front elevation at ½″ scale. Complete dimensions for all views.

Method of Procedure: Follow method already described.



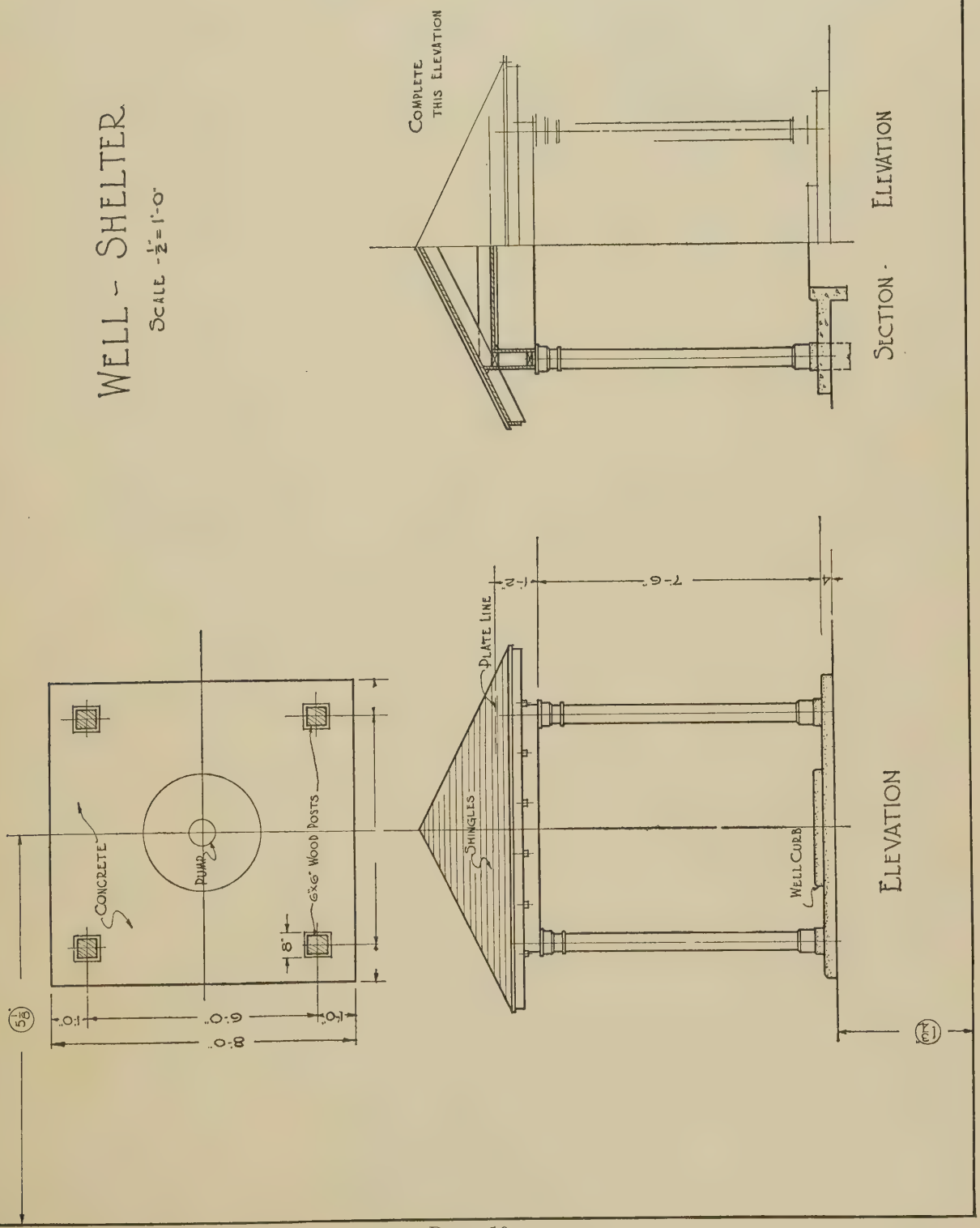

WELL - SHELTER
SCALE - ½" = 1'-0"
COMPLETE THIS ELEVATION
SECTION - ELEVATION
ELEVATION
PLATE LINE
SHINGLES
WELL CURB
CONCRETE
PUMP
6"x6" WOOD POSTS
8'-0"
6'-0"
1'-0"
7'-6"
1'-2"

PLATE 10

PROBLEM 2—**GATEWAY AND FENCE**

(Plate 11)

The gateway illustrated in this problem is especially appropriate for a house of English design. It makes a pleasing transition from the street or drive to lawn or garden.

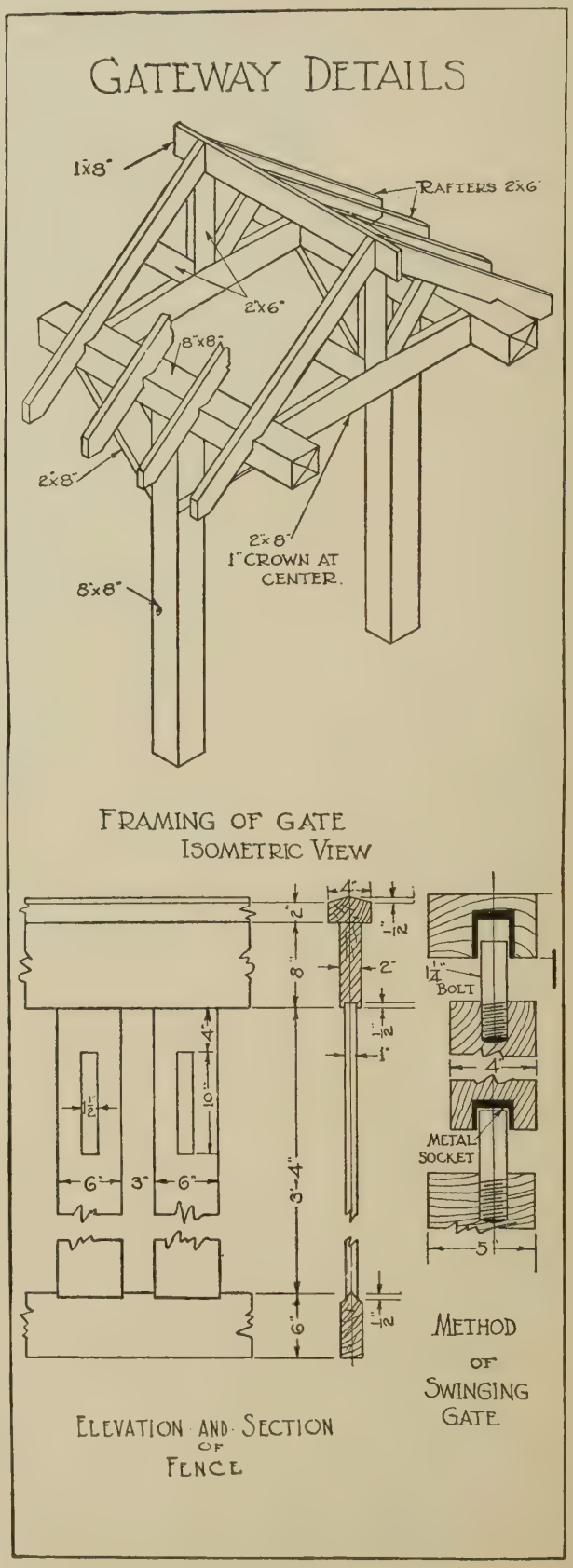
Given: Plan, front elevation, and side elevation, the latter showing framing on one side.

Required: Problem to be drawn as given or it may be varied by placing the gable at right angles to its given position.

Method of Procedure. Order of procedure in drawing the gateway is similar to that outlined in Art. 70. All structural members must be blocked in first.

(See Art. 40 and Fig. 26 for roofs.)

(See Art. 46 for size and spacing of shingles.)



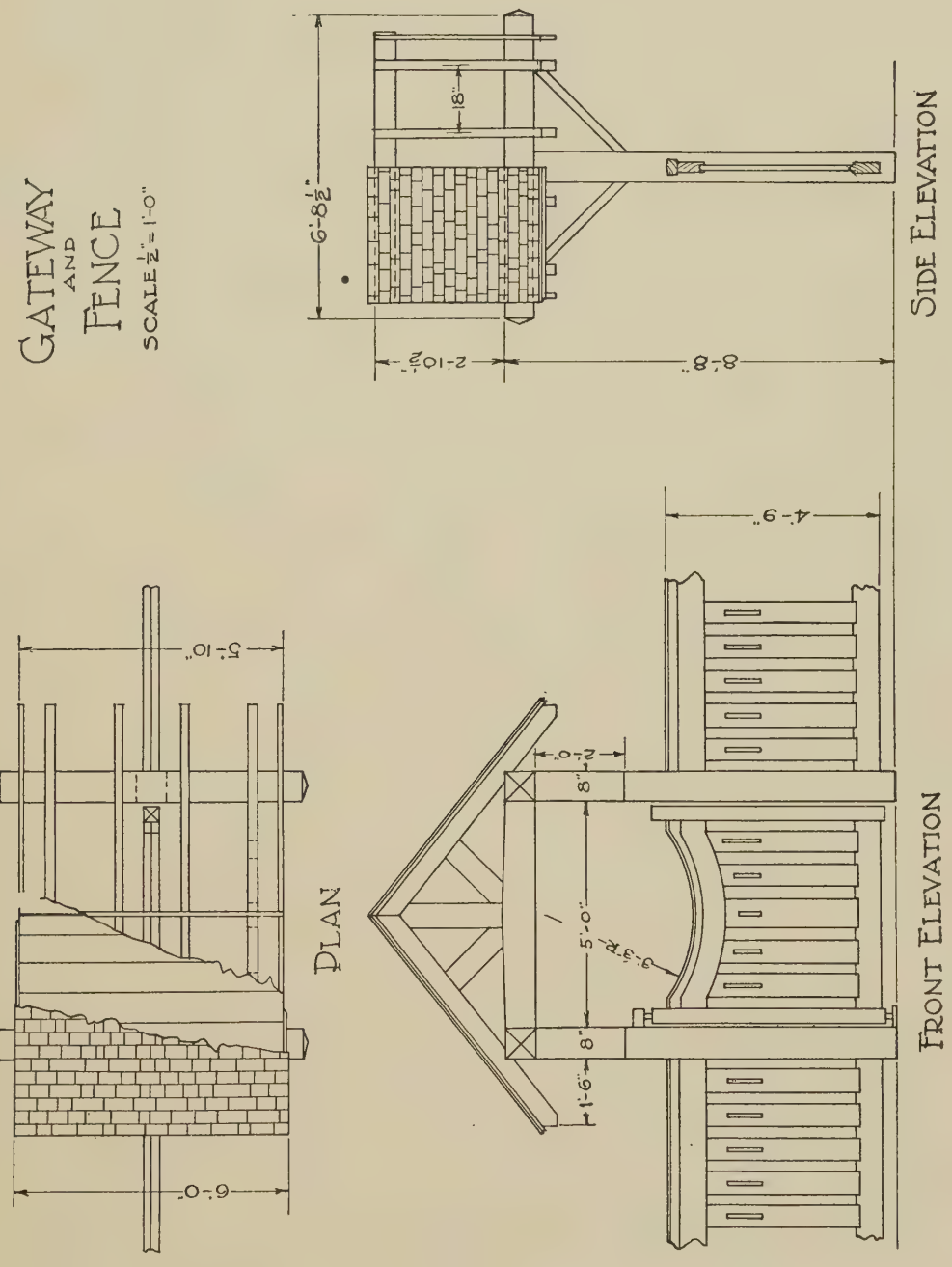

GATEWAY
AND
FENCE
SCALE ½" = 1'-0"
6'-8½"
18"
2'-10½"
8'-8"
SIDE ELEVATION
5'-10"
6'-0"
PLAN
4'-9"
2'-0"
8"
5'-0"
3'-3"
8"
1'-6"
FRONT ELEVATION

PLATE 11

PROBLEM 3—**PARK SHELTER**

(Plate 12)

The park shelter is suitable either for the village or city park, or for the private garden.

Given: A half floor plan partly complete, a front elevation and a half section of the design as shown, also a half section of an alternate design.

Required: Draw and complete half floor plan in detail; draw front elevation as shown, also a full section view omitting alternate design. Or, change plan to correspond to alternate design and draw front elevation and full section of alternate design.

Method of Procedure. (Plate 4, Article 45.)

(1) Locate and draw center lines for plan, elevation and section.

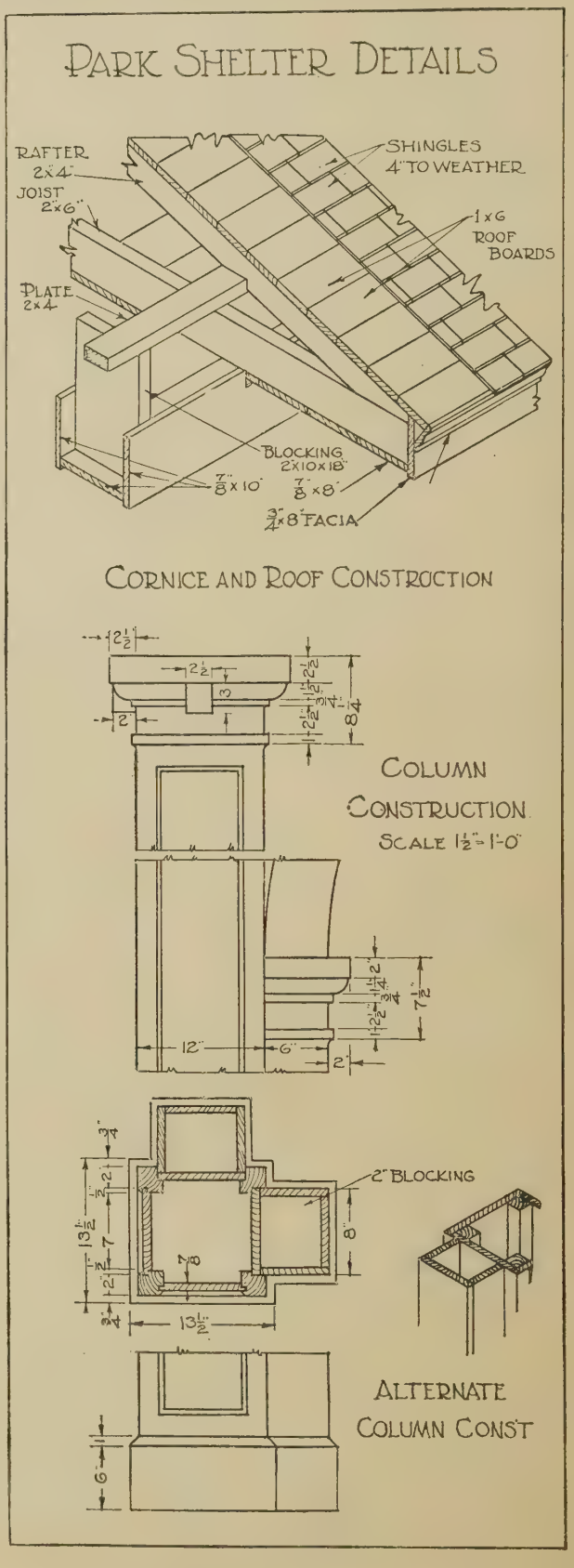
(2) Draw ground line.

(3) Measure and draw lines for main heights.

(4) Locate and draw rafter in section according to given pitch as in Art. 70.

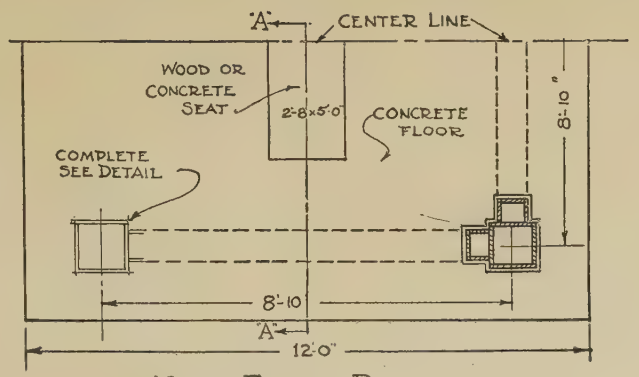
(5) Complete cornice (See Plate 3 for crown mould).

(6) Project cornice lines to front elevation and complete column as shown in detail sheet.



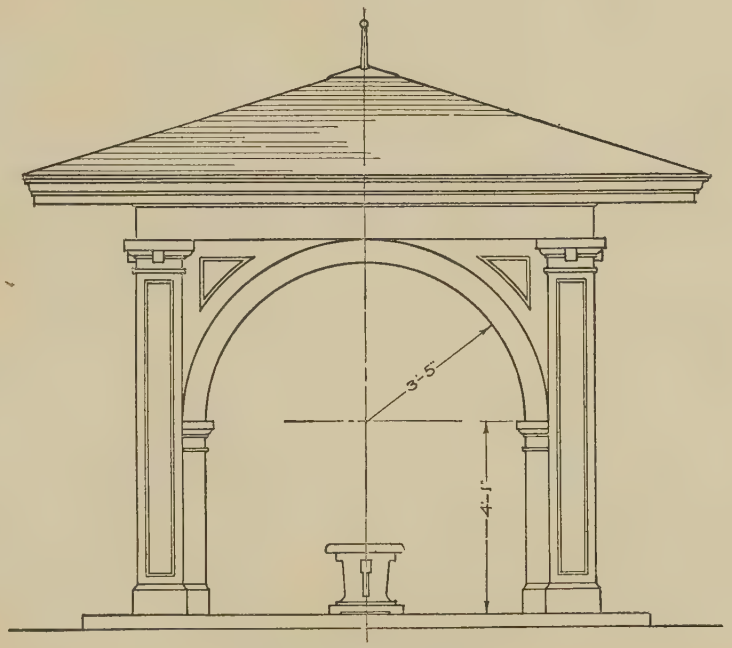
PARK SHELTER

SCALE ½"=1-0

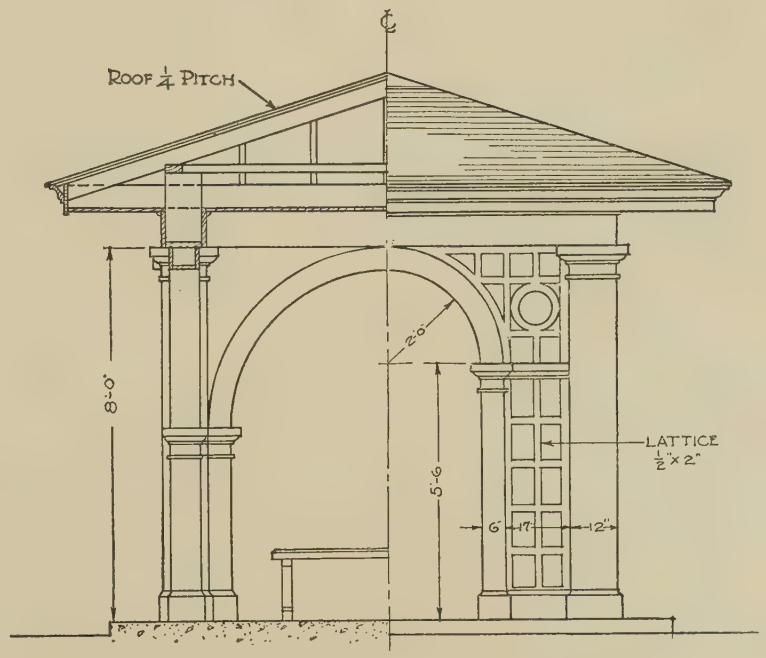


HALF FLOOR PLAN

NOTE
DRAW COMPLETE SECTION BELOW
OR IF ALTERNATE DESIGN IS CHOSEN
MAKE PLAN AND FULL SECTION TO
CORRESPOND



FRONT ELEVATION



HALF SECTION ON A-A - ALTERNATE-HALF-ELEVATION

PROBLEM 4—**GARDEN PERGOLA**

(Plate 13)

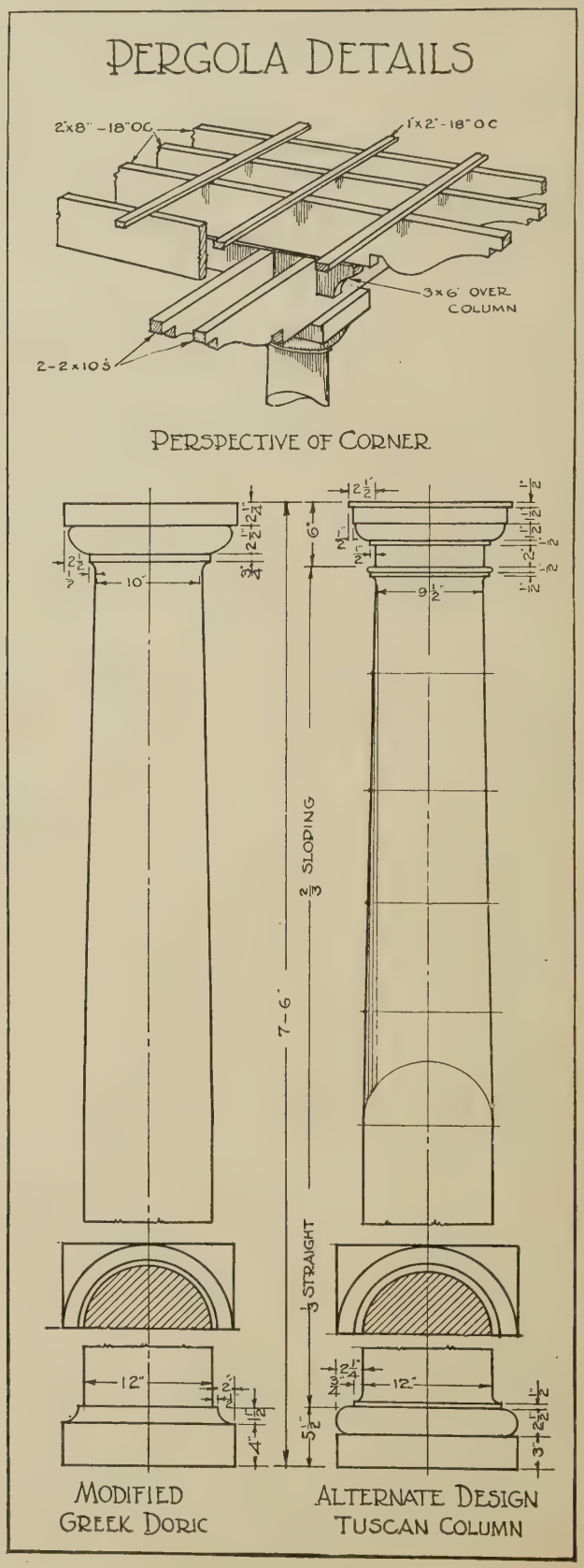
The purpose of the pergola is chiefly decorative or ornamental. It may be used in a variety of ways.

Its chief use however is as a lawn or garden adjunct. A well-designed pergola will add much to the appearance of the landscape about the house. Pergolas, moreover, are easily erected by the home craftsman. This problem brings in the design and application of different types of columns. Two types are shown in the details. A modified Greek Doric with base added, and the typical Roman Tuscan according to the proportions given in *Vignola.*

Given: Part floor plan and part roof plan, a complete front elevation and a part side elevation.

Required: Draw floor plan and roof plan as shown. Draw front elevation, also complete and draw side elevation. Or, substitute Tuscan column and draw views as required.

Method of procedure the same as in the preceding problems. (Art. 70.)



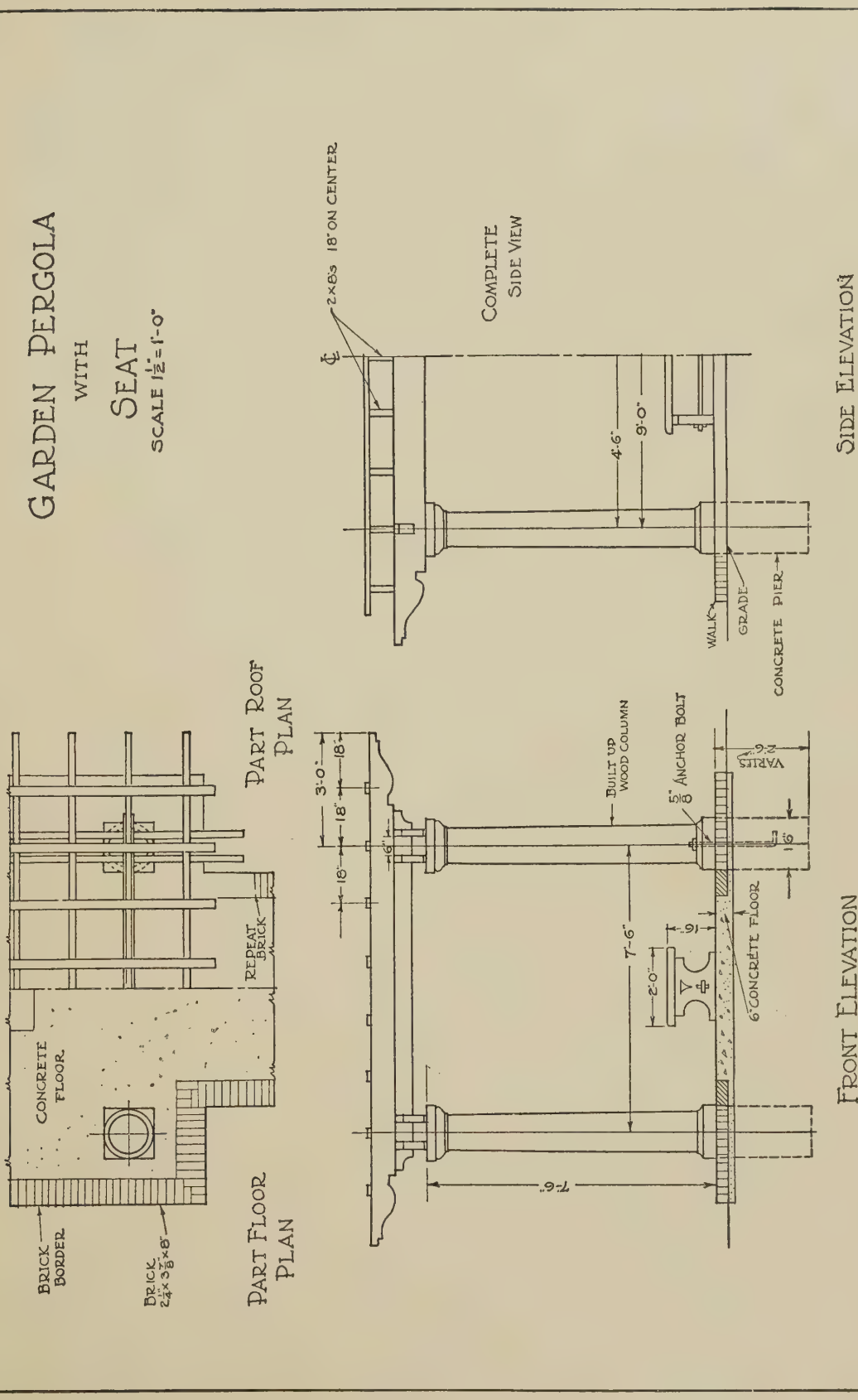
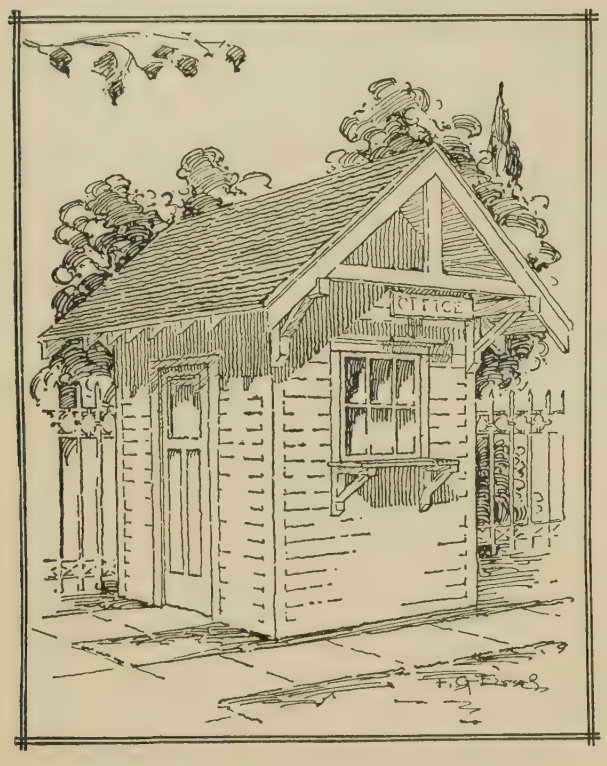

GARDEN PERGOLA
WITH
SEAT
SCALE 1½"=1'-0"
PART ROOF PLAN
PART FLOOR PLAN
BRICK BORDER
BRICK 2½×3⅝×8"
CONCRETE FLOOR
REPEAT BRICK
COMPLETE SIDE VIEW
2×6's 18" ON CENTER
4'-6"
9'-0"
WALK
GRADE
CONCRETE PIER
SIDE ELEVATION
3'-0"
18"
18"
18"
6"
BUILT UP WOOD COLUMN
⅝" ANCHOR BOLT
VARIES
2'-6"
1'-6"
7'-6"
2'-0"
6" CONCRETE FLOOR
7'-6"
FRONT ELEVATION

PLATE 13



PROBLEM 5—TICKET OFFICE FOR ATHLETIC FIELD

(Plates 14 and 15)

In the ticket office we have a complete small building. As distinguished from the preceding shelters, it has not only the protecting roof but also side walls, doors and windows. It brings in practically all of the principles of building construction involved in larger structures. It may well serve as a problem in any school carpentry shop, thus correlating the work of the drafting room with that of the carpentry class. It may be used at the entrance to a school athletic field, fair grounds or as a small real estate field office. The building may be made portable by substituting a 4″x6″ skid or runner on either side for the concrete foundations.

The lay-out of the sheet has been changed slightly in this problem. A suggested title strip has been included at the bottom, which may be used thruout the series at the discretion of the instructor.

Given: Complete detailed plan, front elevation, section, side elevation and a complete detail sheet.

Required: Draw detail sheet as shown. Draw plan sheet as shown, following progressive steps as illustrated. (Figs. 46, 47 and 48.)

73. Method of Procedure. (1) In this case the student should draw the detail sheet first. Before drawing the window see Arts. 26 and 54 and Plate 5. For the door see Art. 52 and Fig. 32. For the mouldings see Plate 3. A careful study should also be made of the balloon type of frame and its details at this time. (Art. 32 and Fig. 16.) In drawing the

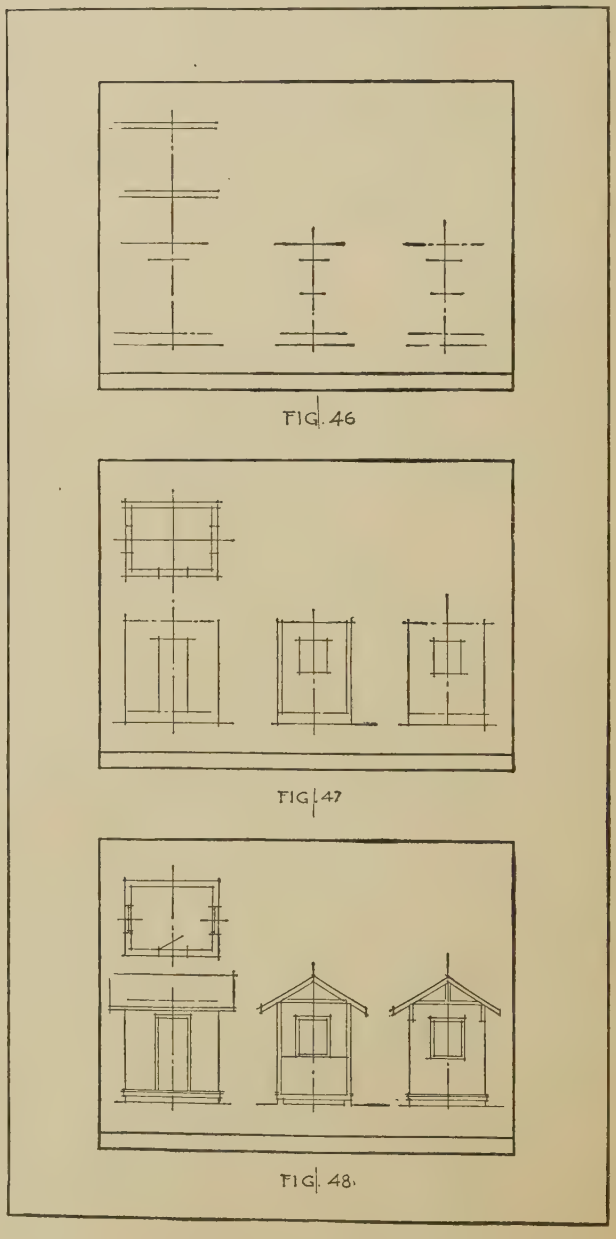
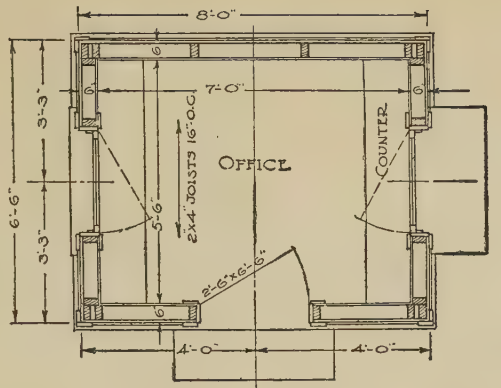


FIG. 46

FIG. 47

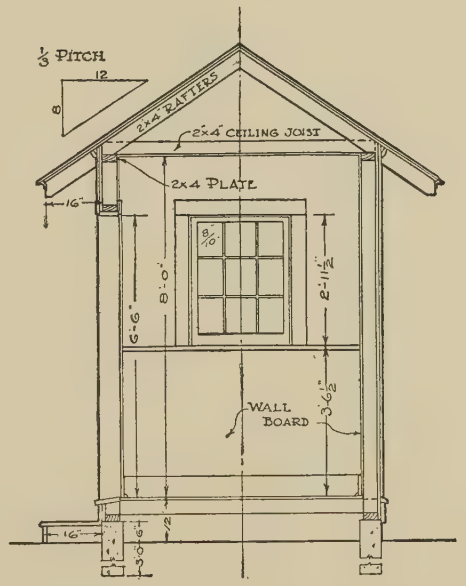
FIG. 48.

TICKET OFFICE
FOR
ATHLETIC FIELD



FLOOR – PLAN

FRONT ELEVATION



SECTION A-A

SIDE ELEVATION

NAME OF SCHOOL LOCATION	SCALE ½"=1'-0"	ARCHITECTURAL – DRAFTING DATE	NAME SHEET No

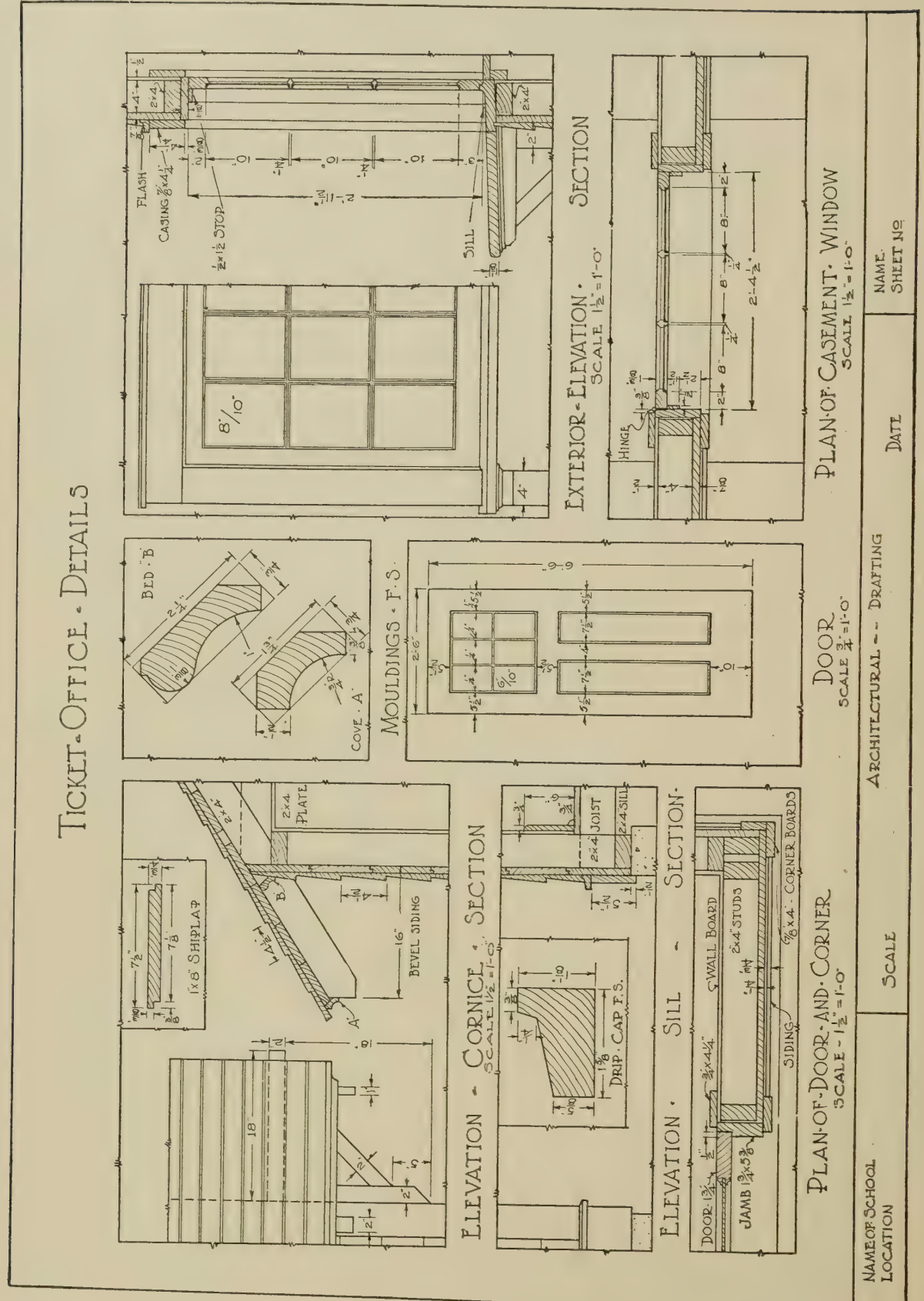

TICKET-OFFICE-DETAILS
EXTERIOR-ELEVATION-SECTION
SCALE 1½"=1'-0"
PLAN-OF-CASEMENT-WINDOW
SCALE 1½"=1'-0"
DOOR
SCALE ¾"=1'-0"
MOULDINGS-F.S.
BED-B
COVE-A
ELEVATION-CORNICE-SECTION
SCALE 1½"=1'-0"
ELEVATION-SILL-SECTION
PLAN-OF-DOOR-AND-CORNER
SCALE-1½"=1'-0"
NAME OF SCHOOL
LOCATION
SCALE
ARCHITECTURAL--DRAFTING
DATE
NAME
SHEET NO

PLATE 15

details, block in the main structural members first.

(2) In drawing the plan, Plate 14, locate center lines of plan, elevations and section.

(3) Draw ground line, floor line, top and bottom of sash openings for windows and plate line in section and elevations.

(4) Draw front and rear wall lines of the plan, also locate and draw lines for the inner and outer faces of the studs.

(5) Lay out widths of walls in plan, projecting same vertically to the front elevation.

(6) Draw outside wall lines of section and side elevation.

(7) Locate and draw sash widths of window openings, also door opening in plan and elevations.

(8) Draw plate in sectional view, and locate rafters with given pitch as in Art. 70.

(9) Complete the cornice in the section view, giving it the required projection beyond the plate.

(10) Next project cornice lines to elevations making the profiles the same as in section.

(11) Complete the door and windows adding casing, sash and muntin lines. Simplify the muntin lines to suit the smaller scale.

(12) Draw outside trim such as corner boards, brackets, water table, etc.

(13) In completing the plan locate and draw studs and add lines representing sheathing and inside finish of wall board.

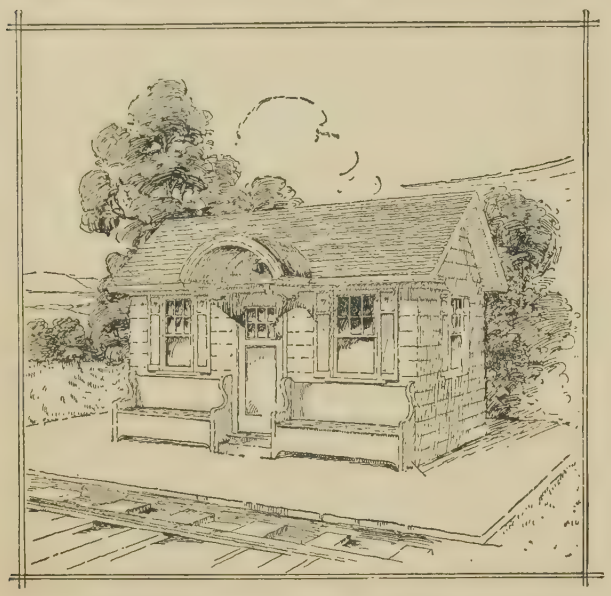
The plan in this problem is a detailed plan and should not be drawn at less than ½″ or ¾″ scale. The typical ¼″-scale plan omits the showing of studs and minor details, allowing 6″ or 7″ for the full width of the frame wall.

74. Dimensioning and Lettering. (1) Dimension to center of openings.

(2) Dimensions from corners are taken from foundation wall line or face of sheathing. Another method is to take dimensions from the outside face of studs, and add 1″ to all sides for foundation size.

(3) Heights are shown in section. Dimension always from structural members and not from trim.

(4) Notice the glass size of windows in the elevations. For size and position of lettering see Art. 71. Make shingles, siding and graining with diluted ink.



PROBLEM 6—**INTERURBAN WAITING STATION**

(Plate 16)

The small waiting station is a practical project and one which would be especially suitable for a small community located on an electric line connecting two cities or in the suburbs of a large city. The design is Colonial with shingle roof and shutters stained a dark green. With a suitable setting of shrubbery and lawn it would add much to the architectural value of any community.

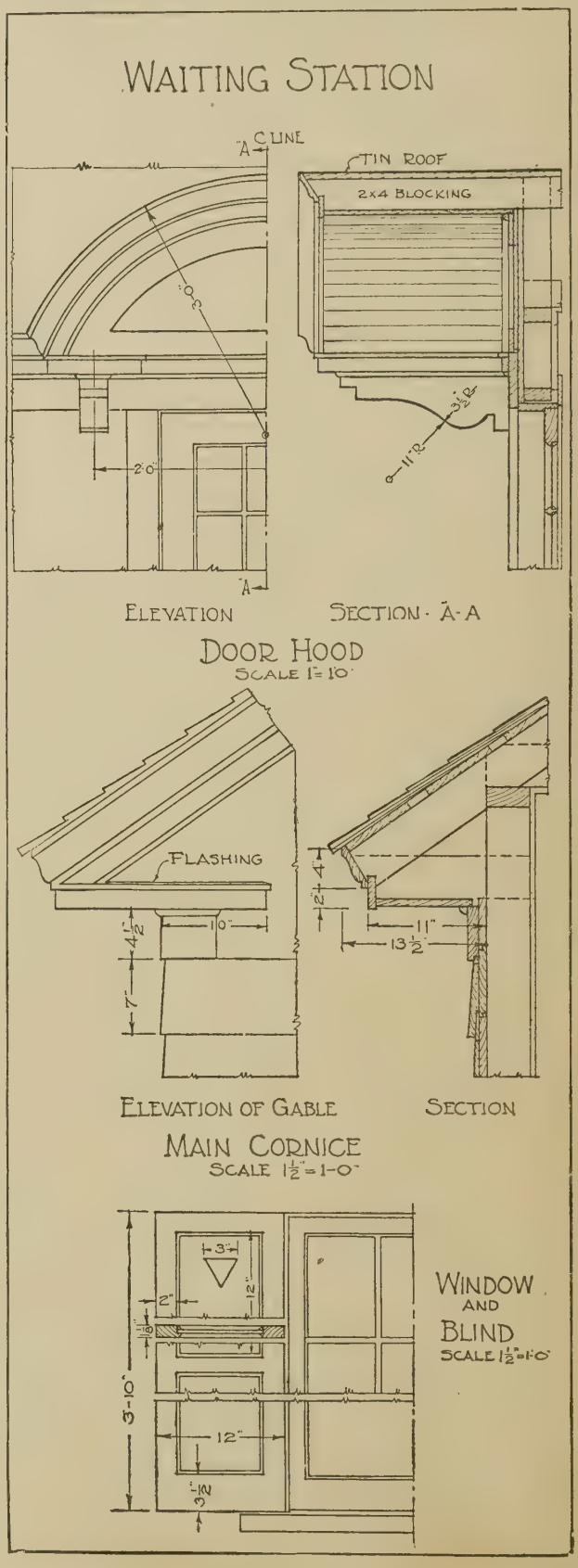
Given: Floor plan, front elevation and part section.

Required: Draw plate as shown or substitute a half elevation in place of the half section.

The instructor may, to advantage, require two sheets: the first, with the plan and front elevation placed the long way of the sheet instead of as shown, and on the second a complete section and side elevation placed horizontally on the sheet with details of the entrance hood. This would be similar to Plate 26.

Additional sheets of roof plan, framing plan and elevations might also be drawn. For construction of the typical double-hung window see Art. 54 and Plate 5. For inside partition and door see Art 52 and Fig. 32.

Method of Procedure: Similar to Prob. 5, Art. 73.



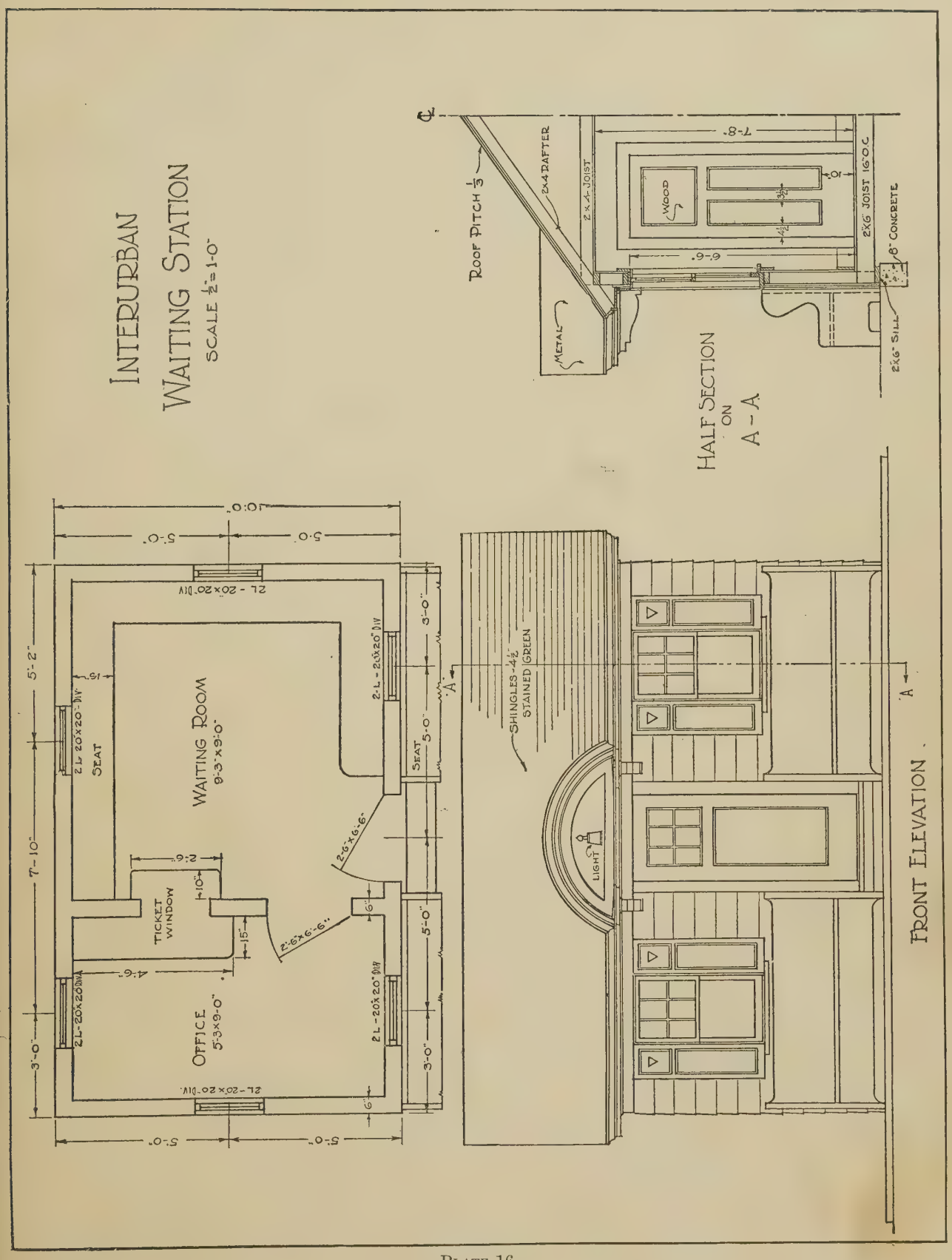

INTERURBAN
WAITING STATION
SCALE ½" = 1'-0"
ROOF PITCH ⅓
2x4 RAFTER
2x4 JOIST
WOOD
2x6 JOIST 16" O.C.
8" CONCRETE
METAL
2x6" SILL
HALF SECTION ON A-A
FRONT ELEVATION
SHINGLES - 4½" STAINED GREEN
LIGHT
WAITING ROOM 9'-3"x9'-0"
SEAT
TICKET WINDOW
OFFICE 5'-3"x9'-0"
2L - 20"x20" DIV.
2'-6"x6'-6"
10'-0"
5'-2"
7'-10"
3'-0"

PLATE 16

PROBLEM 7—**PORTABLE PLAYHOUSE**

(Plate 17)

The portable playhouse not only serves for the amusement of the children and as a place to put their toys, but it may also be used as a garden house to store garden implements and supplies or, since the ceiling is of sufficient height, it might be used for emergency sleeping quarters with plenty of space for one cot.

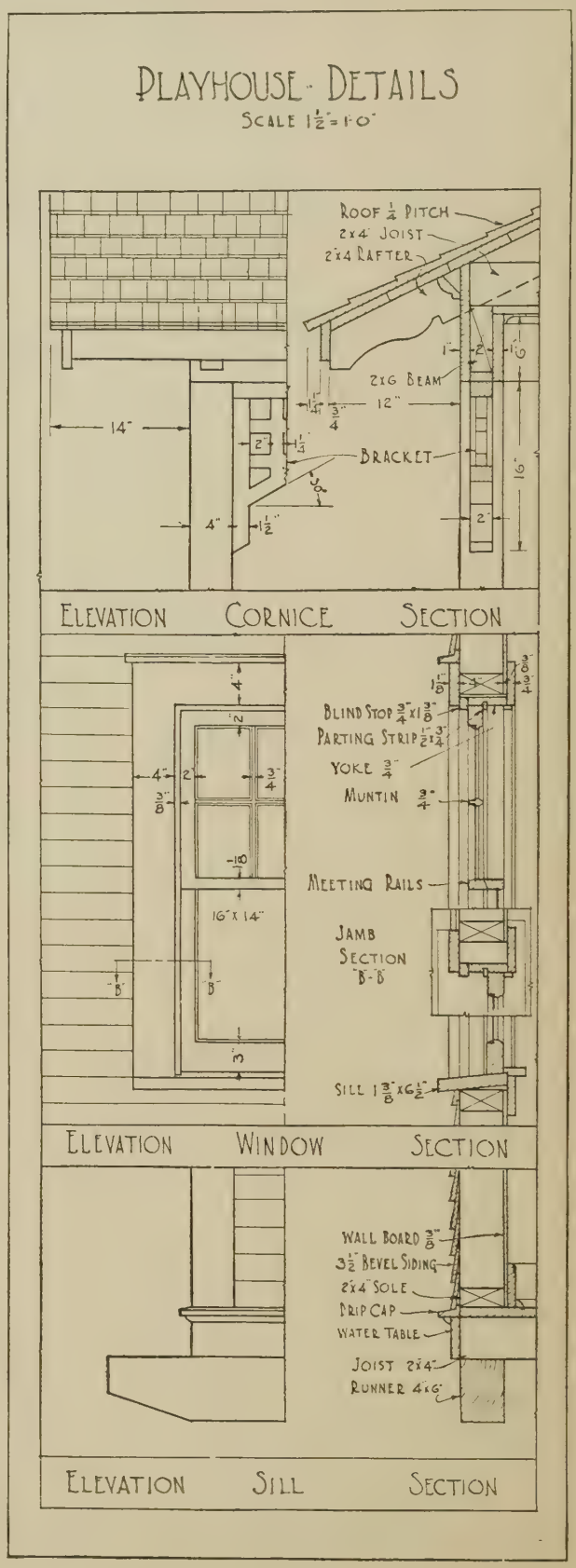
Since the sheathing has been omitted the frame should be securely braced diagonally.

The double-hung window shown in detail illustrates a cheap form of construction in keeping with the inexpensive construction of the playhouse.

Given: Floor plan and incomplete front and side elevations.

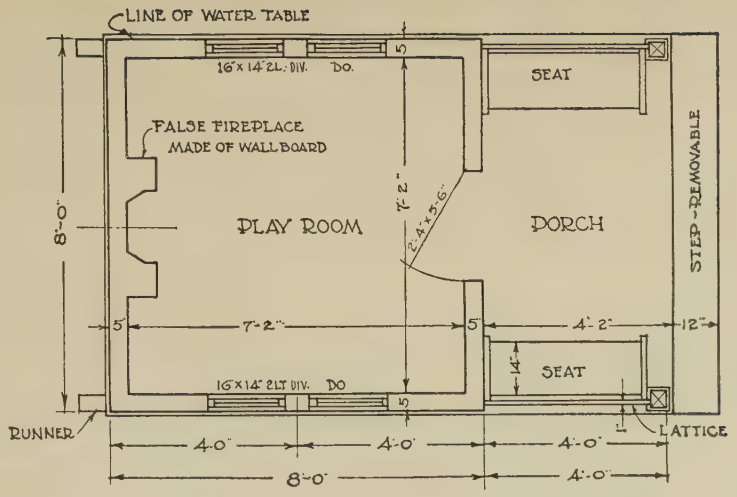
Required: Draw plate as given completing all views at the ½″ scale.

Method of Procedure: Similar to Prob. 5, Art. 73, except where section is not required, the position of the plate and the lines of the rafters should be blocked in lightly in the side elevation in order to determine location of cornice lines in front elevation.



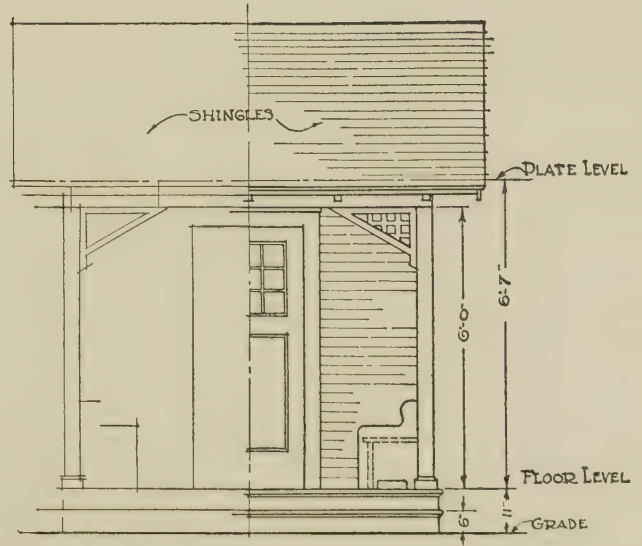
PORTABLE PLAYHOUSE

SCALE ½" = 1-0"

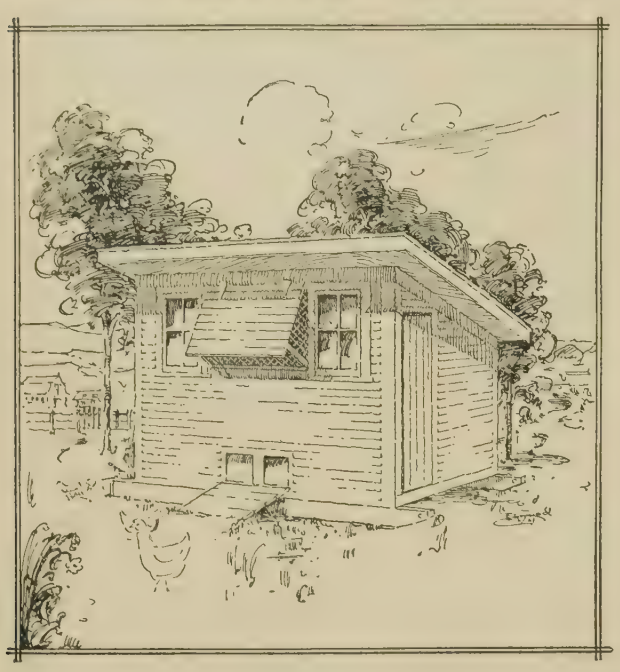


FLOOR PLAN

LEFT SIDE ELEVATION



FRONT ELEVATION



PROBLEM 8—**PORTABLE COLONY POULTRY HOUSE**

(Plate 18)

The colony poultry house is a valuable as well as an interesting problem for the boy from farm or village. The portable type is considered best where there is an abundance of range, as it may readily be moved to new feeding grounds whenever desired. The house has a capacity of from 20 to 25 hens, allowing two to five square feet of floor space for each hen. Ventilation is secured by means of the board in the rear wall, which is hinged at the bottom and opens in, thus deflecting the air currents up and away from the roosts. The screened opening at the front may be covered with muslin during cold weather.

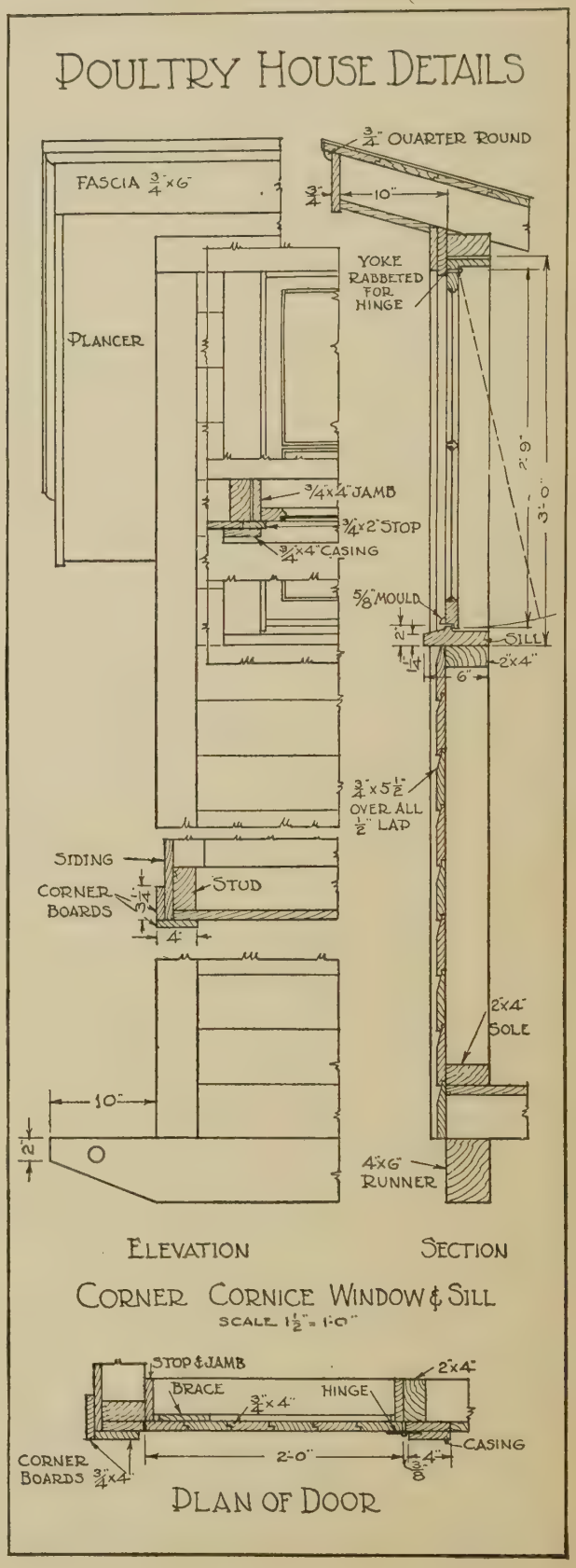
Given: Partial plan, section and elevations.

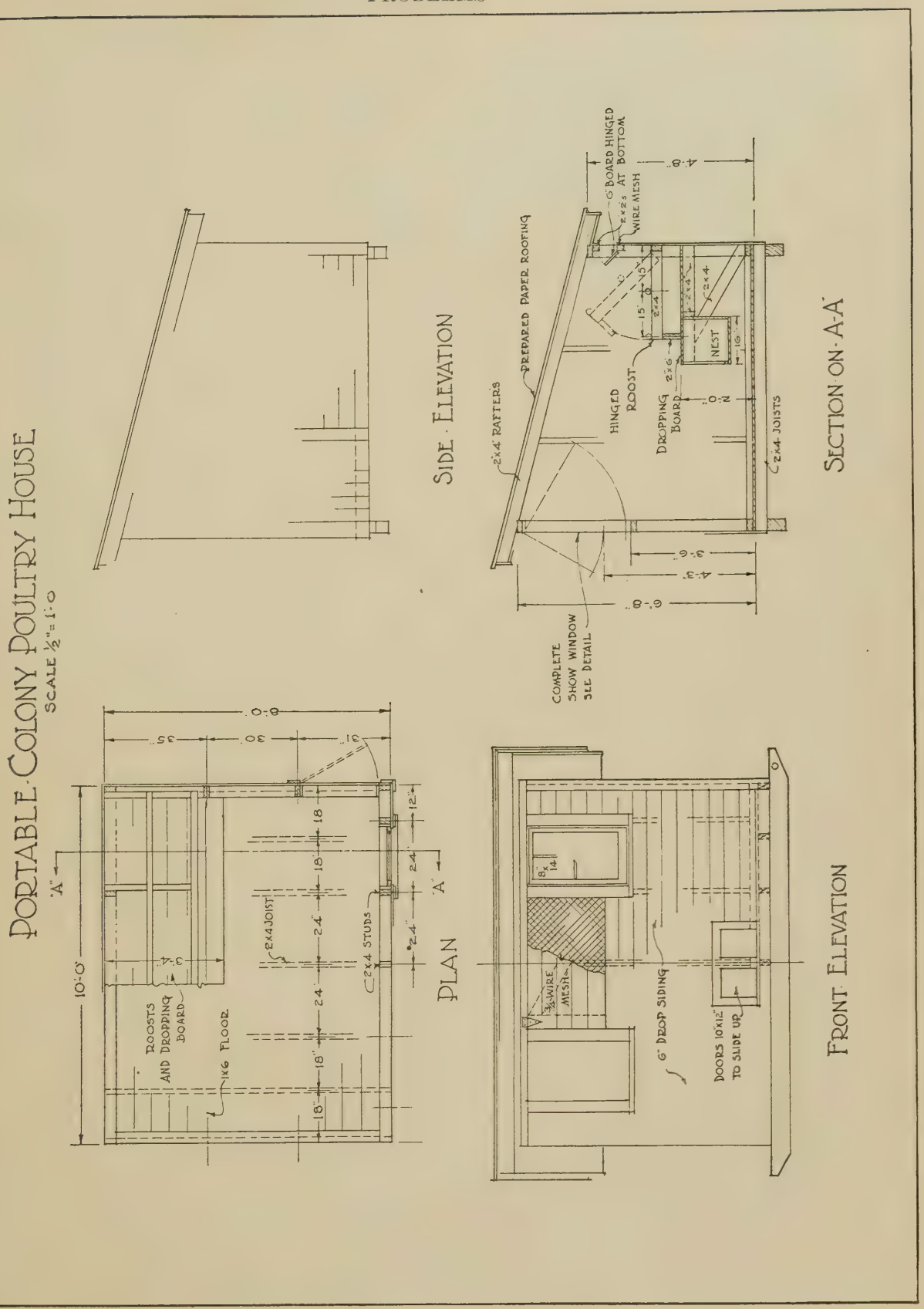
Required: Draw plate as shown, completing detailed plan, sections, and elevations at ½″ scale.

Method of Procedure:

(1) Study the spacing of the views carefully. With light lines block in the rectangles which will enclose the views.

(2) Since the detailed plan and section tell the most about the construction of the house, these should be drawn first, blocking in struc-




PORTABLE COLONY POULTRY HOUSE
SCALE ½" = 1'-0
SIDE ELEVATION
SECTION ON A-A
PLAN
FRONT ELEVATION
2x4 RAFTERS
PREPARED PAPER ROOFING
6" BOARD HINGED AT BOTTOM
2x2's WIRE MESH
HINGED ROOST
DROPPING BOARD
NEST
2x4 JOISTS
COMPLETE SHOW WINDOW SEE DETAIL
2x4 JOISTS
2x4 STUDS
ROOSTS AND DROPPING BOARD
1x6 FLOOR
½ WIRE MESH
6" DROP SIDING
DOORS 10x12 TO SLIDE UP

tural members before proceeding with the details.

(3) Follow order similar to preceding problems in finishing and dimensioning.

Should a detail sheet also be desired to accompany the plan sheet, a half front elevation may be drawn in detail at the 1½″ scale with a vertical wall section to correspond at the right.

PROBLEM 9—**COLONY HOG HOUSE**

(Plate 19)

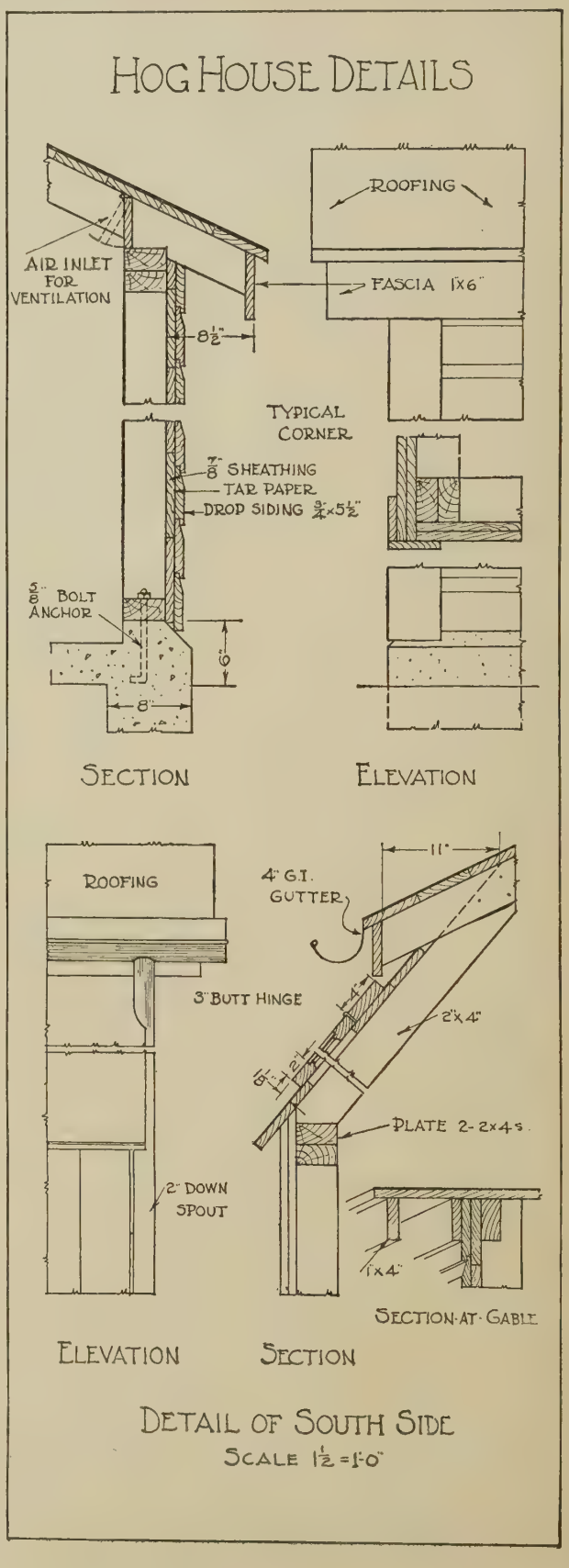
The chief advantage of this house is that it gives the maximum amount of sunlight to every part of the pen at all times of the year. It should be placed with the windows facing toward the south. One unit of two pens has been taken for the problem. As many additional units may be added as desired.

Given: Partial plan, elevation and section.

Required: Complete all views at ½″ scale as indicated in the plan sheet.

Method of Procedure: Similar to preceding problems.

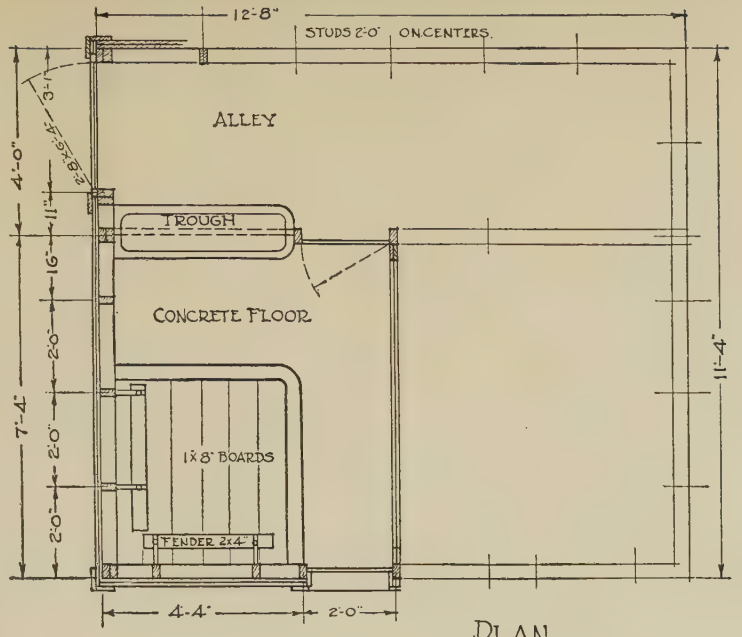
If a complete detail sheet is desired as an additional plate an auxiliary view of the windows is suggested.



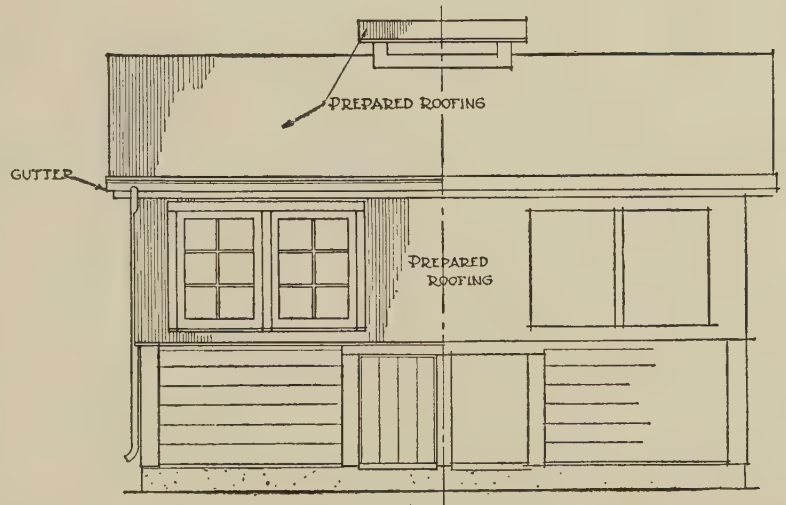
HOG HOUSE

SCALE $\frac{1}{2}$" = 1'-0"

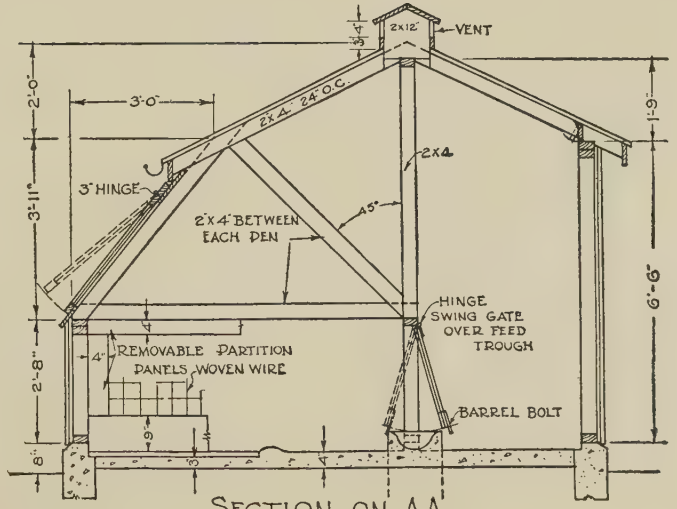
NOTE - TWO PENS ARE SHOWN ADDITIONAL UNITS MAY BE ADDED AS DESIRED.



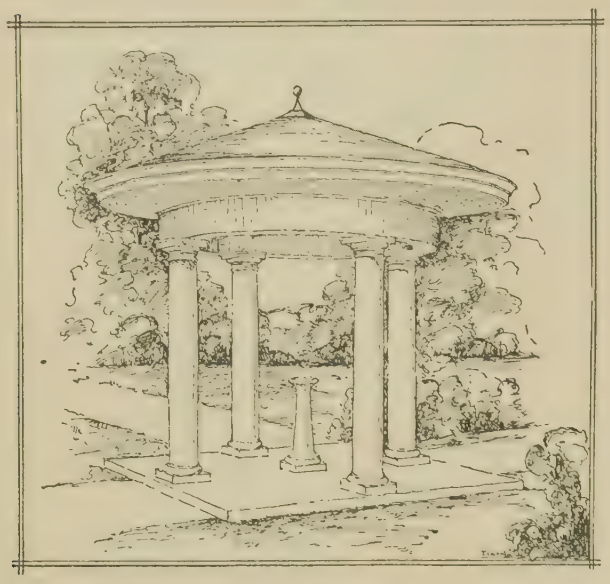
PLAN



SOUTH ELEVATION



SECTION ON A-A



PROBLEM 10—**FOUNTAIN SHELTER**

This is an alternate design for the well or fountain shelter of Prob. 1. The shelter is to be circular with an 11′ square concrete base. The center line circle of the columns is nine feet in diameter. The built-up wood column is a typical example of the Roman Doric order, and while perhaps heavy in appearance for a wood structure it is given for the study of the proportions involved. The projection of the cornice may be reduced if desired.

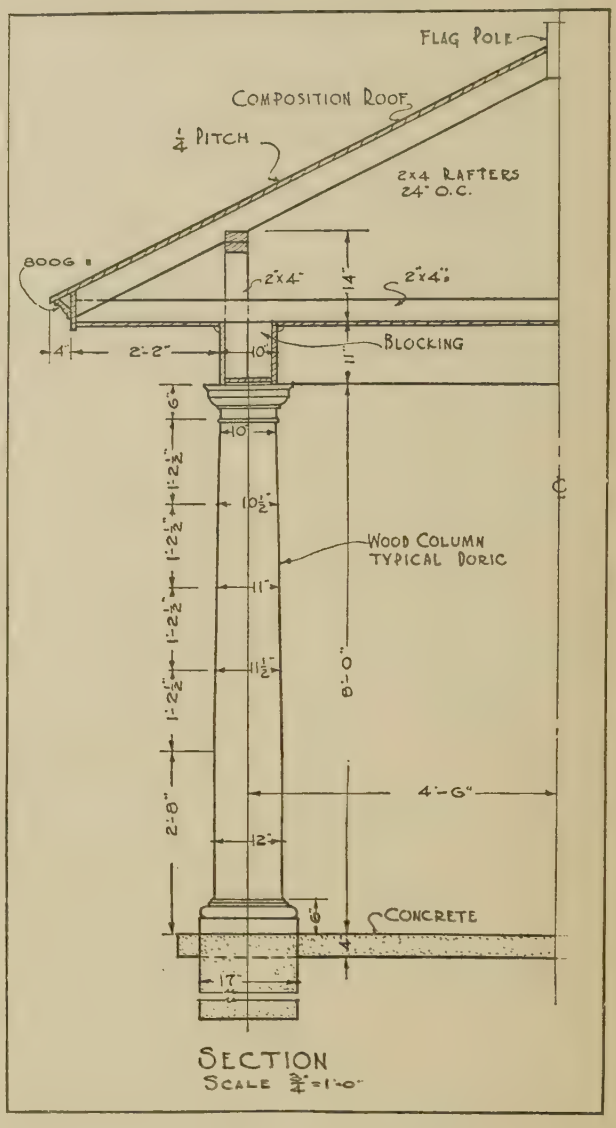
Given: Typical half-section detail, and perspective of a complete shelter erected according to these dimensions.

Required: Draw plan, elevation and complete section at ½″ scale.

Procedure:

(1) Study spacing of previous problems for arrangement of views.

(2) Draw plan and section; then project vertically and horizontally to complete front elevation.



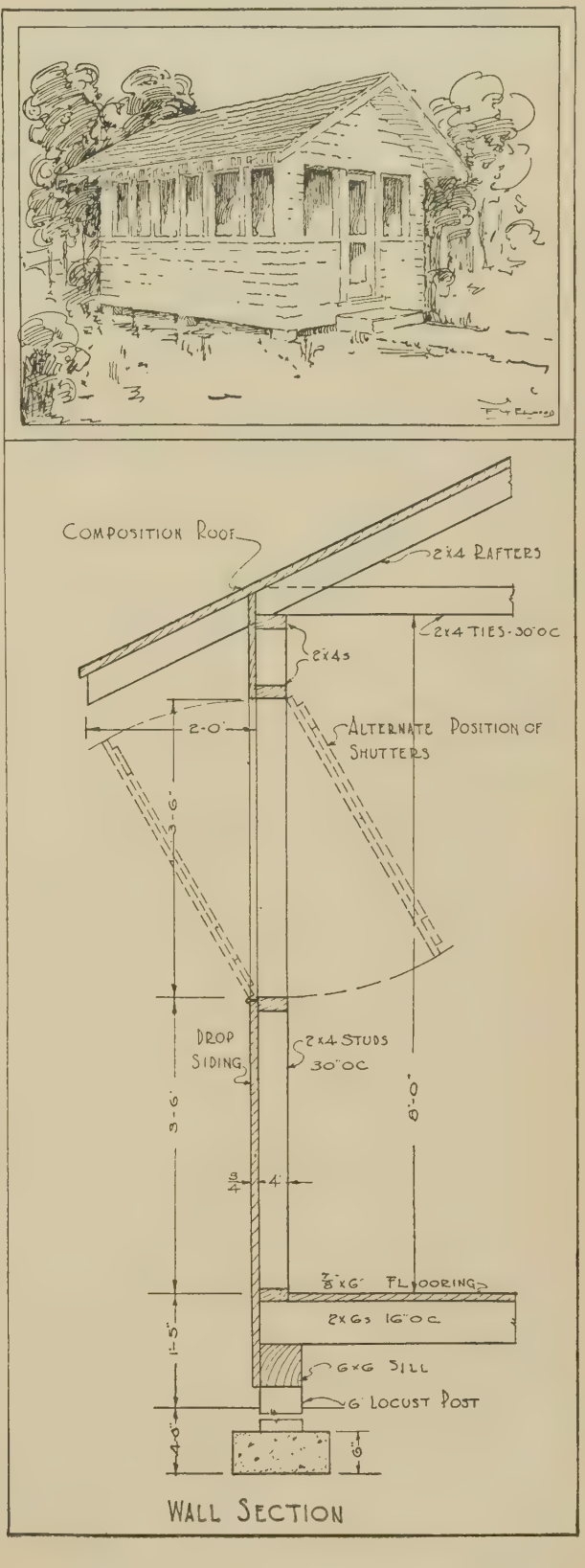
PROBLEM 11—SUMMER CAMP OR SHACK

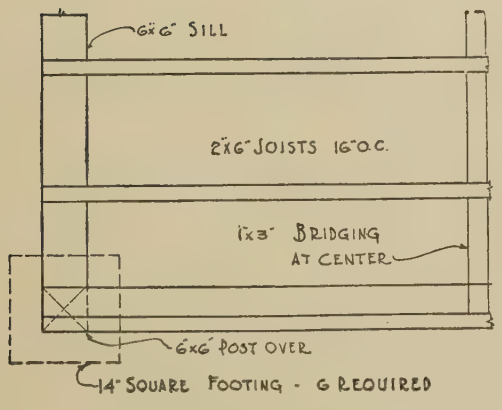
A small one-room summer camp or shack, which would also be adaptable for a wayside refreshment stand offers an interesting problem.

The foundations are of 6″x6″ locust posts, creosoted and resting on flat stones or a concrete base. The walls are made of as light and inexpensive construction as possible, consisting of a 2″x4″ wood framework with studs spaced 30″ on centers. Drop siding or wide boards nailed clapboard fashion may be used for the outside covering. If it is desired to give the inside a more finished appearance wall board may be nailed between the studs, leaving the studs exposed, and then staining them green or brown. The roof consists of composition roofing over matched boards.

Given: Detailed wall section, corner of floor framing plan and perspective sketch.

Required: Framing plan showing location of piers, joists and studs. Front elevation showing studs and plate in dotted lines. (Plate 18.) End elevation and wall section at $\frac{1}{2}'' = 1'\ 0''$ scale.





PART · FRAMING PLAN ·

PROBLEM 12—REAL ESTATE FIELD OFFICE

(Plate 20)

The small real estate field office, as indicated on the accompanying sketch sheet, makes an attractive little building suitable for a realtor's subdivision.

Given: The problem has been sketched freehand with suggested spacing on the sheet, also the main dimensions.

Required: Either plan, front and side elevations, as indicated, or substitute a complete sectional view in place of the side elevation. Draw at ½″ = 1′ 0″ scale.

PROBLEM 13—REFRESHMENT STAND

Problem: To design and draw a refreshment stand to be located at the intersection of two highways, one of which is a transcontinental auto trail.

Specifications: To be a framed structure supported on concrete piers. Outside dimensions of building to be 12′x16′ or 12′x12′. Show arrangement for shelves and counters. Outside finish to be either 6″ or 8″ bevel or drop siding with square edge. Inside finish to be wall board. As the building will not be used in cold weather, windows are not necessary, but shutters should be provided similar to those for the summer shack. (Prob. 13.) Use hip roof.

Required: Draw detailed plan showing spacing of studs, locate counters and shelves and indicate piers by means of dotted lines. Draw front elevation facing the principal road. A small gable might be placed on this side over the entrance to emphasize its importance. Draw section showing ceiling heights, structural members, etc., at scale of ½″ to 1 foot.

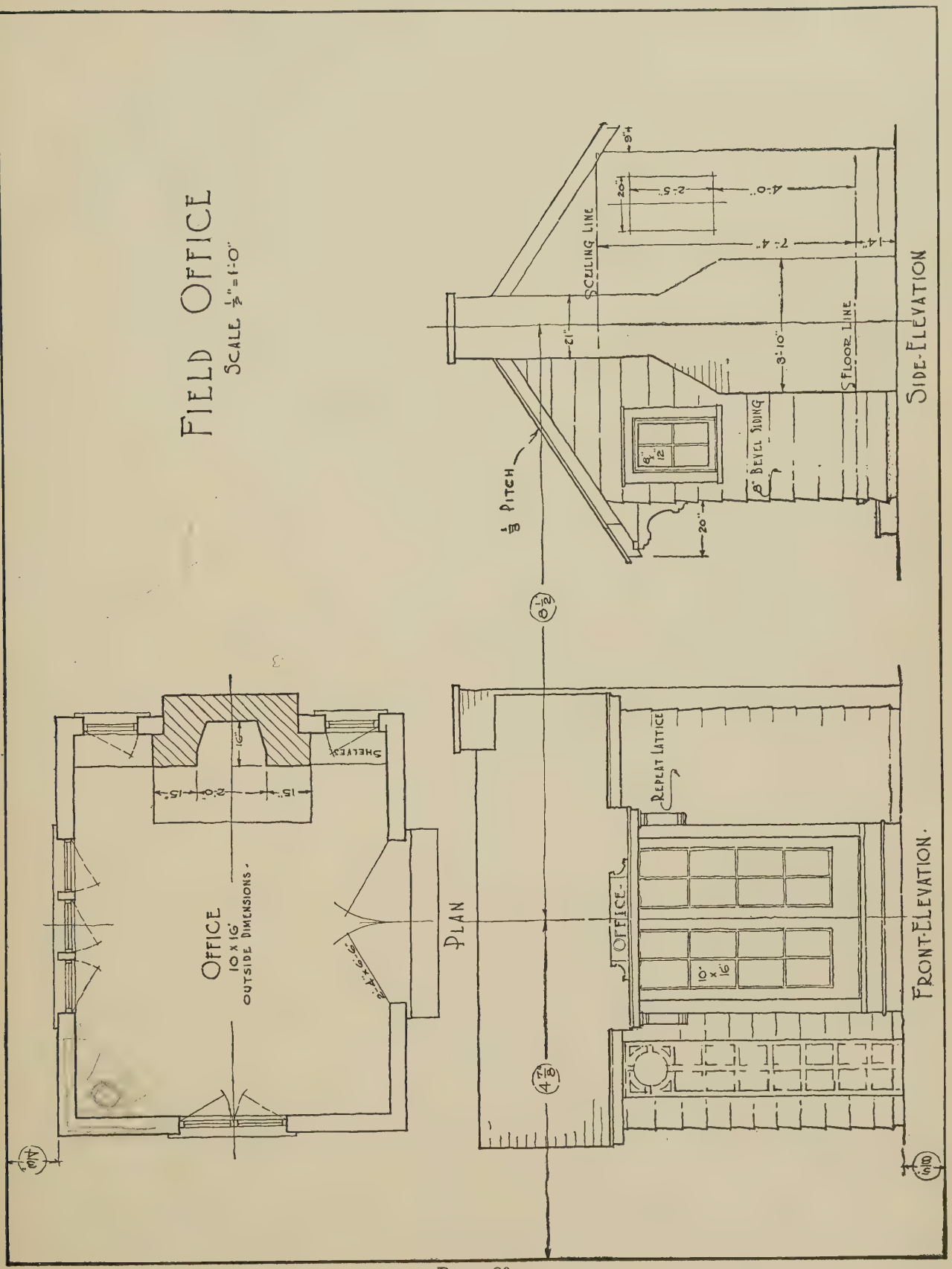

FIELD OFFICE
SCALE ½" = 1'-0"
SIDE-ELEVATION
CEILING LINE
FLOOR LINE
8" BEVEL SIDING
½ PITCH
20"
4'-0"
2'-5"
7'-4"
3'-10"
12"
PLAN
OFFICE
10' × 16'
OUTSIDE DIMENSIONS.
SHELVES
2'-0"
FRONT-ELEVATION.
REPEAT LATTICE
OFFICE
10' × 16'

PLATE 20

Group II

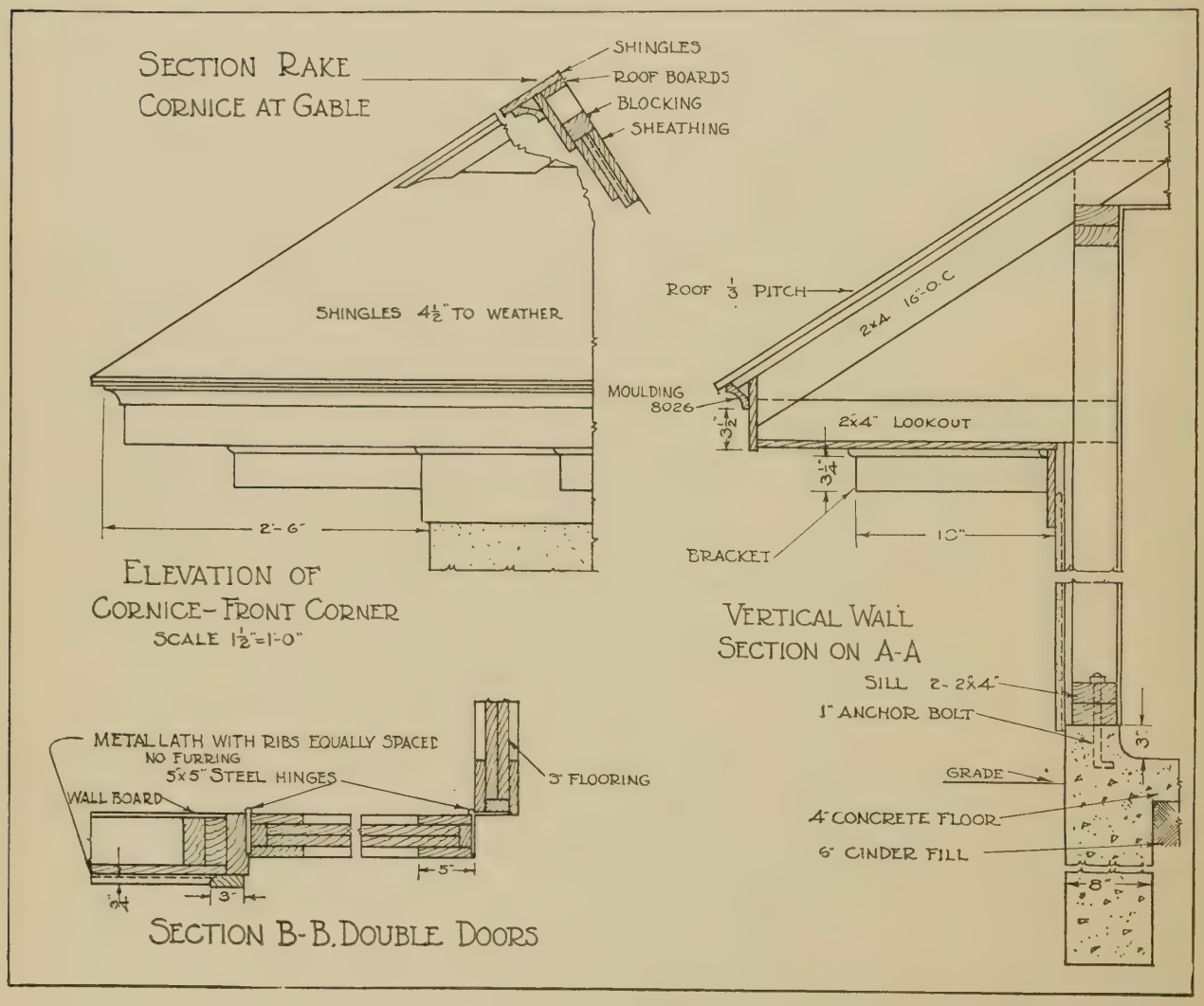
PROBLEM 14—ONE-CAR GARAGE
(Plate 21)

Garages are the most common of all the small structures. The typical one here illustrated harmonizes with a house in the Colonial style. The wall covering is stucco on metal lath over the sheathing. (Art. 44, Fig. 30.) A narrow or split-wood lath may be used in place of the metal lath. These are nailed to wood furring strips which are in turn attached to the sheathing. The stucco should always be stopped at least 5″ or 6″ above grade to prevent moisture from seeping up and staining the wall, also to prevent freezing and cracking. The wood sill is anchored to the foundation wall every 6′ 0″ by bolts set in the concrete. There are numerous ways of hanging garage doors. The accordion door is used in this case. The student should refer to trade catalogs for the various types of door hangers.

Given: Plan and partial elevations.

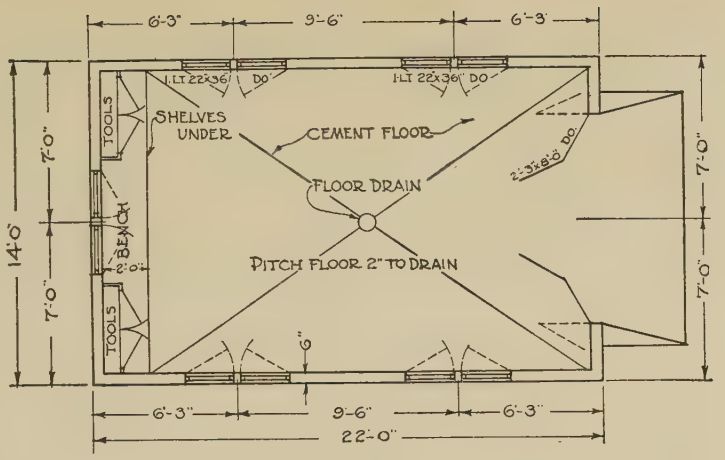
Required: Plan, complete side elevation, half front elevation, and half section.

Method of Procedure: As in previous problems.

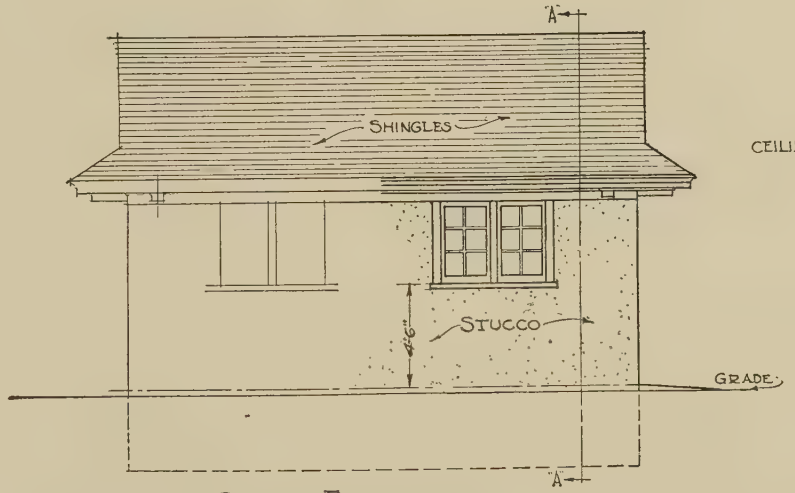


ONE CAR GARAGE
IN
COLONIAL STYLE

SCALE $\frac{1}{4}$"=1'-0"

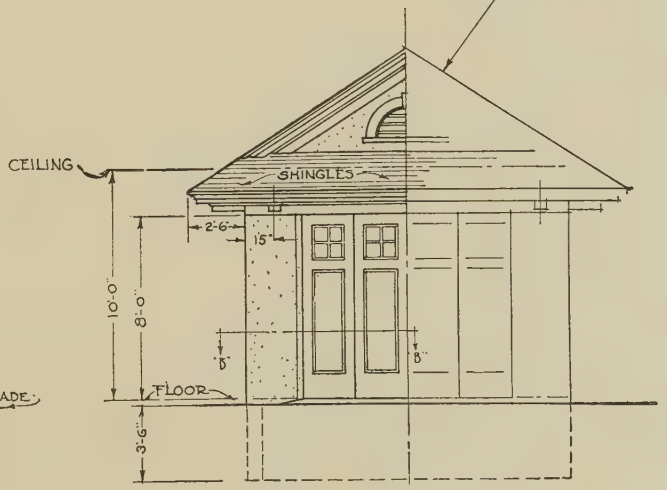


PLAN



SIDE ELEVATION

NOTE - COMPLETE HALF ELEVATION OR HALF SECTION



FRONT ELEVATION

PROBLEM 15—SUMMER CAMP BUNGALOW

(Plates 22, 23 and 24)

The summer camp bungalow is a step removed from the one-room shack or camp of Prob. 11, Group 1.

It is a comfortable, snug structure and suitable in size for a family of four or five, whose members do not wish to put up with the inconveniences of a temporary shack. The design shown may be readily adapted to an all-the-year home in a Southern climate. It will harmonize best with a site in a hilly or rolling country by lake or stream.

The chief requirements of a summer cottage are plenty of windows well screened, screened porches, a good weather-tight roof, convenient toilet facilities and a generous fireplace for chilly, rainy days. The raised paneled ceiling gives an effect of airiness and coolness.

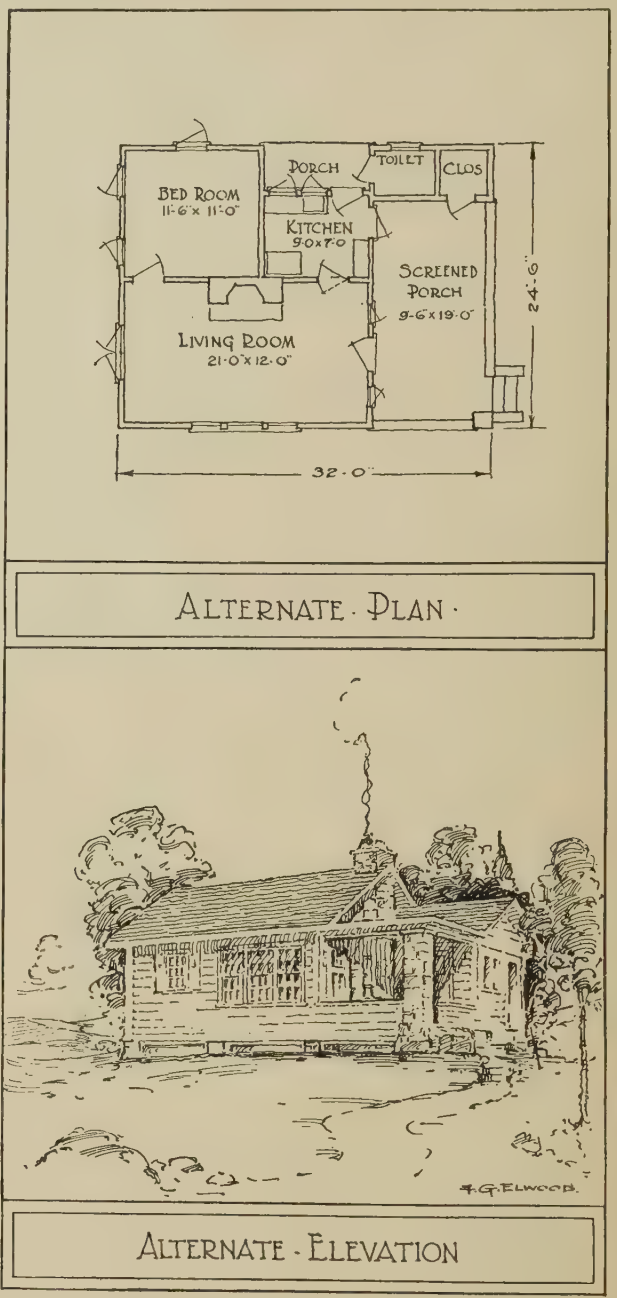
The door from the kitchen to the screened porch permits serving practically all the meals outside.

Construction: A typical balloon frame serves as the basis for all bungalows or summer camps.

The sill is supported by stone or concrete piers instead of a continuous foundation. Cedar or locust posts, creosoted and set on concrete or stone, may also be used. The exterior covering may be of rough boards run horizontally, battened boards placed vertically, bevel or drop siding, shingles, clapboards or slabs over the studs.

For inside finish, wall board may be nailed to the inside of the studs and the joints covered with strips of wood stained, or the wall board may be nailed to the outside of the studs under the siding, leaving the studs exposed on the inside. The studs are then stained green or brown. Care must be exercised in spacing the studs if this method is employed in order to secure a pleasing panel arrangement.

Given: Floor plan with framing plan. Partial front and side elevations with details.

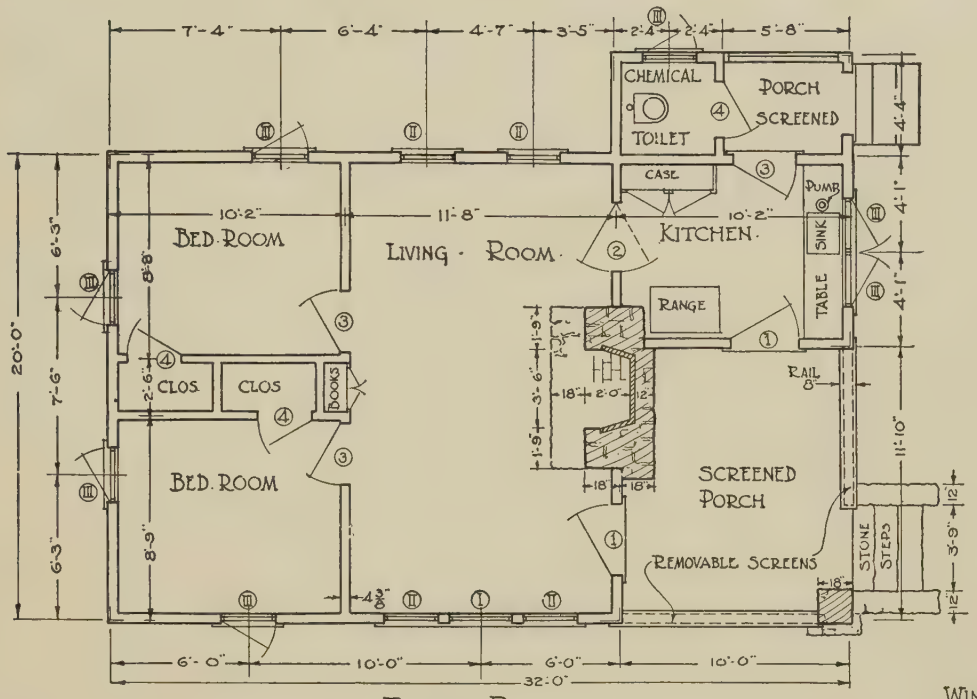


Section with detail of stone fireplace and alternate sketch plan and perspective.

Required: Given plans and elevations complete with details; or using the alternate sketch plan and elevation, make complete working drawings including plans, elevations, section and details.

Method of Procedure: Draw plan and framing plans first, then section and elevations.

SUMMER - BUNGALOW



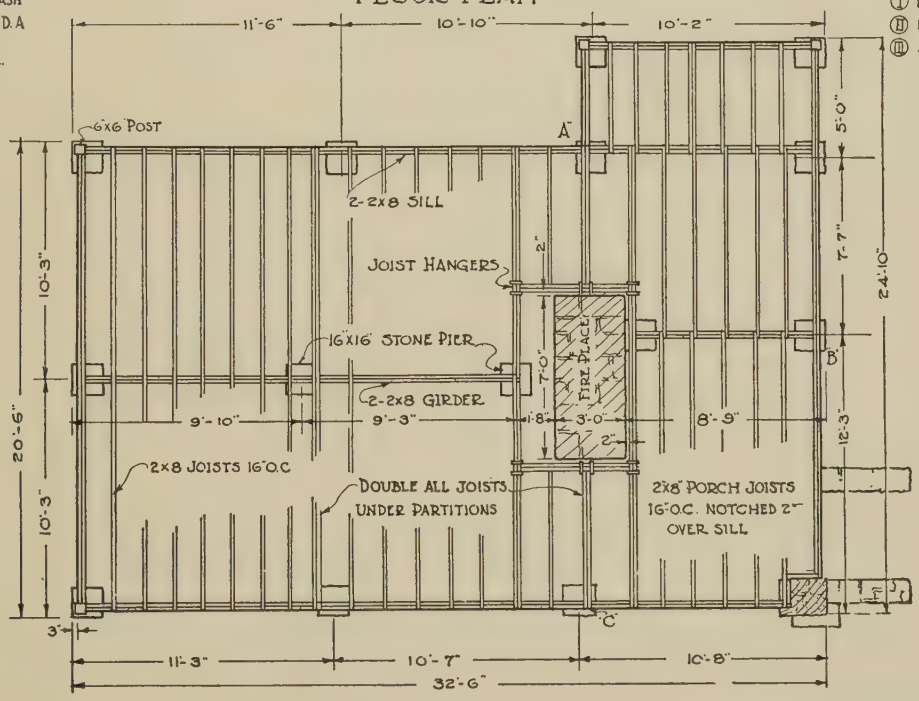
FLOOR PLAN

DOORS

① 3'-0"x7'-0"-1 3/4" SASH
② 3'-0"x7'-0"-1 3/8" D.A
③ 2'-6"x7'-0"-1 3/8"
④ 2'-4"x7'-0"-1 3/8"

WINDOWS

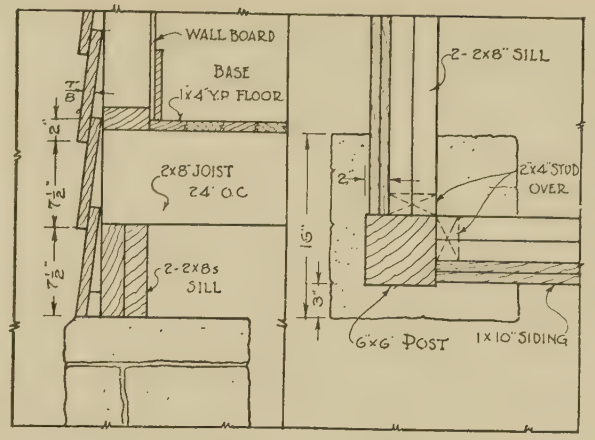
Ⓘ 12 LIGHTS 9"x12" C.R.
Ⓘ 12 · 8"x12" -
Ⓘ 9 · 8"x12"



NOTE-AT CORNERS A, B, & C, USE 2x6" CORNER BOARDS OVER STUDS

FOUNDATION AND FRAMING PLAN.
SCALE 1/4" = 1'-0"

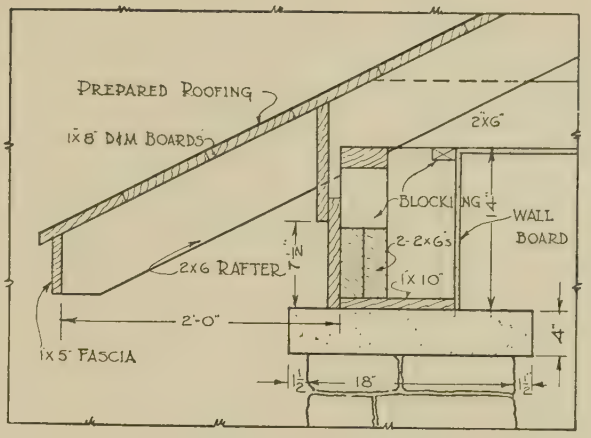
PLATE 22



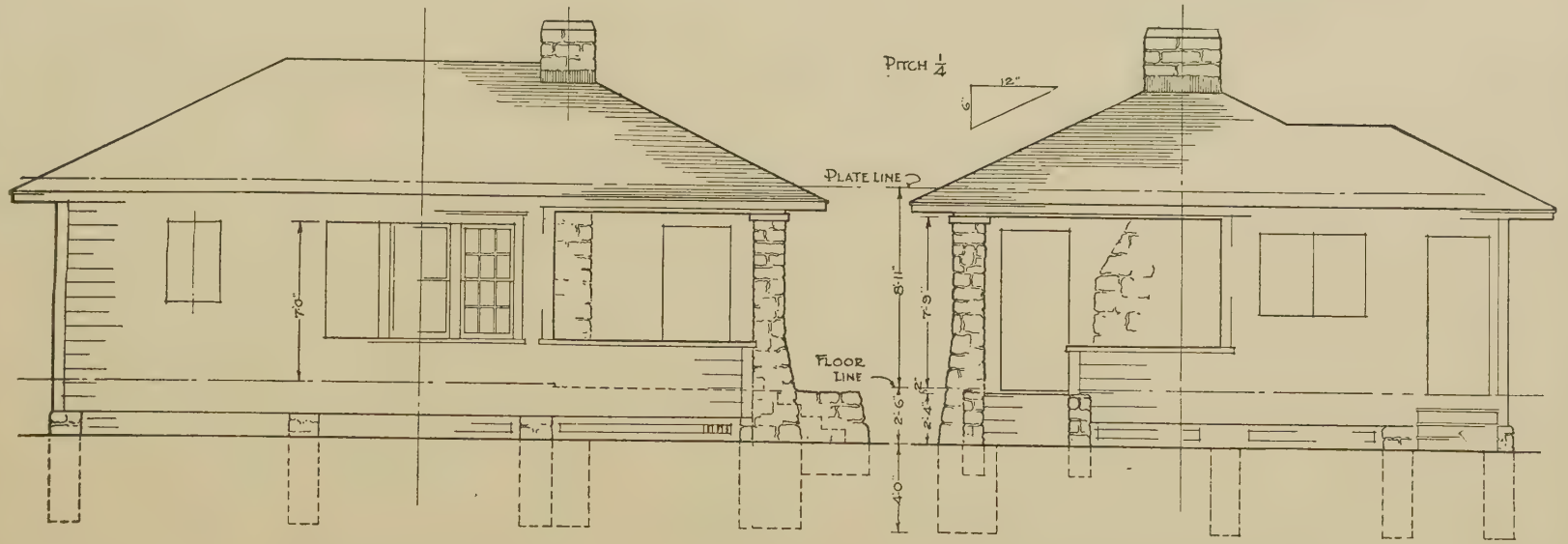
SECTION OF SILL B-B. PLAN OF CORNER

SUMMER BUNGALOW

F.G. ELWOOD



PORCH CORNICE SECTION
SCALE 1½" = 1'-0"



FRONT ELEVATION
SCALE ¼" = 1'-0"

SIDE ELEVATION
SCALE ¼" = 1'-0"

PLATE 23

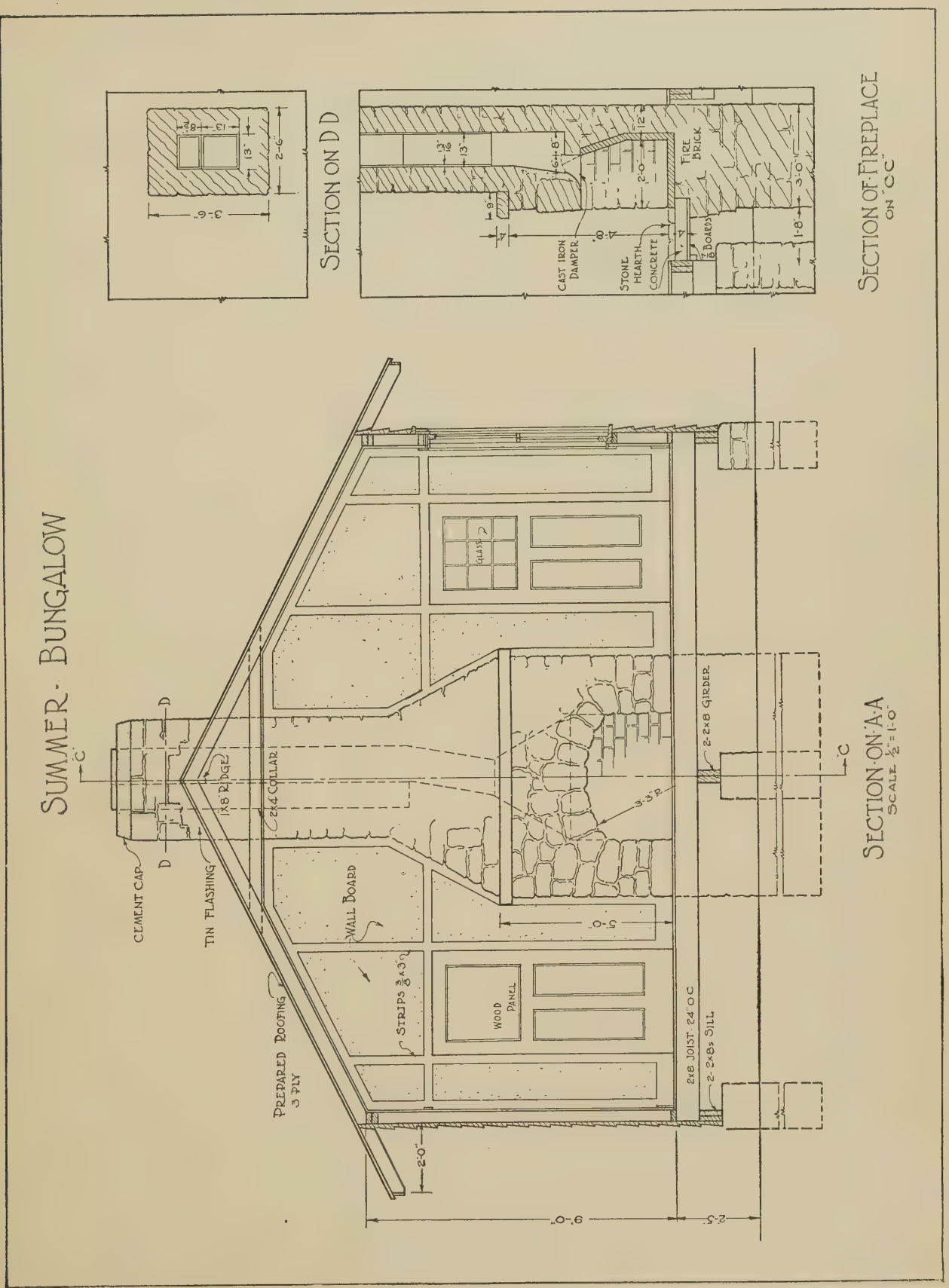

SUMMER · BUNGALOW
SECTION ON D D
SECTION OF FIREPLACE ON C C
SECTION ON A A
SCALE ½" = 1'-0"
CEMENT CAP
TIN FLASHING
1x8 RIDGE
2x4 COLLAR
PREPARED ROOFING 3 PLY
WALL BOARD
STRIPS 3"x3"
WOOD PANEL
2x8 JOIST 24" O.C.
2-2x8 SILL
2-2x8 GIRDER
GLASS
CAST IRON DAMPER
STONE HEARTH
CONCRETE
FIRE BRICK
2-0"
9'-0"
2'-3"

PLATE 24

PROBLEM 16—**BOY SCOUT CABIN**

(PLATES 25, 26 AND 27)

Appealing to all that is imaginative and adventuresome in the nature of the modern boy is the log cabin or shack hidden away by the side of some lake or river and surrounded by wooded hills. Particularly to the troop of boy scouts, such a cabin is ideal. It serves as the goal for week-end "hikes," for taking of tests and studying camp and wood craft.

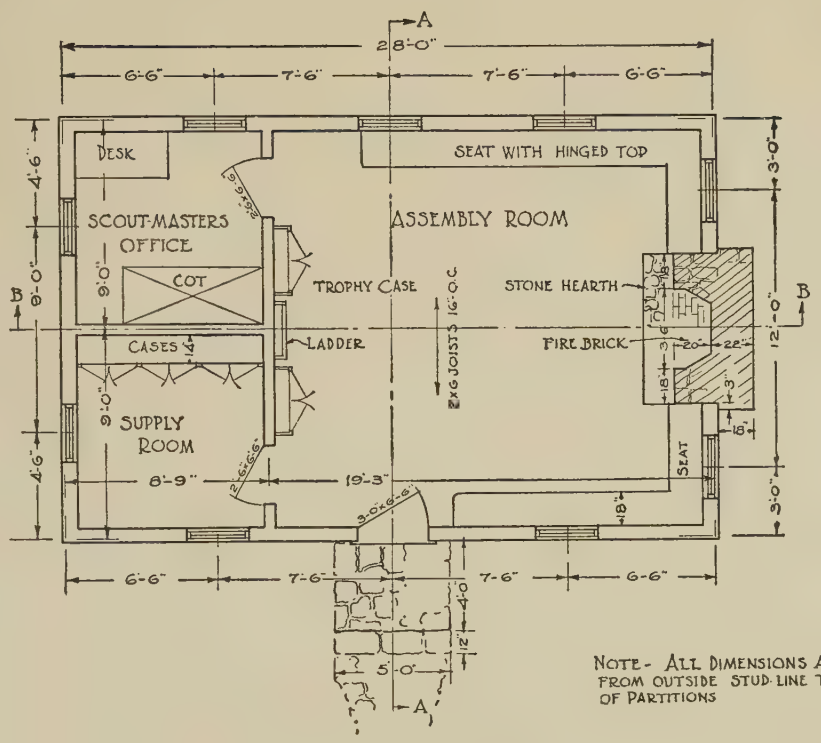
The scoutmaster's office and the supply room with lockers and cases are essential if the cabin is to be used for weekly meetings. The large stone fireplace is the center of attraction and cheer,—an ideal place for telling tales of adventure and woodcraft.

In construction, a typical balloon frame is employed with slabs for sheathing. This will prove cheaper in most cases than solid logs and can be more easily erected. With slabs on the inside it gives the appearance of a solid log cabin. However, the inside lining of slabs may be omitted if desired, leaving the studs exposed. The cracks between the slabs are covered with wire mesh and filled with plaster.

Given: Floor and roof plans, partial elevations, sections and detail.

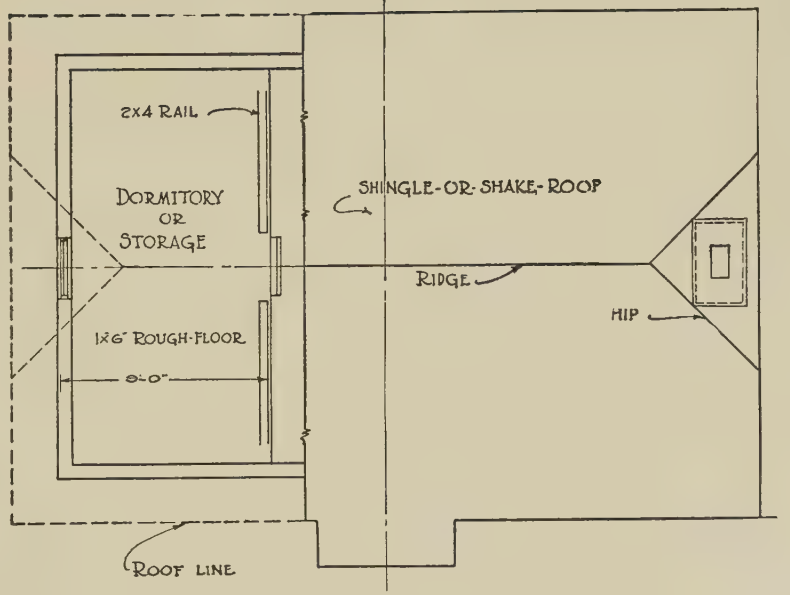
Required: Draw plates as given completing all sections and elevations, also rear and opposite side elevations if desired, or using details shown in Problem 20, draw plans and elevations for solid log cabin, making details to accompany the same.

BOY SCOUT CABIN
FOR
TROOP SIX

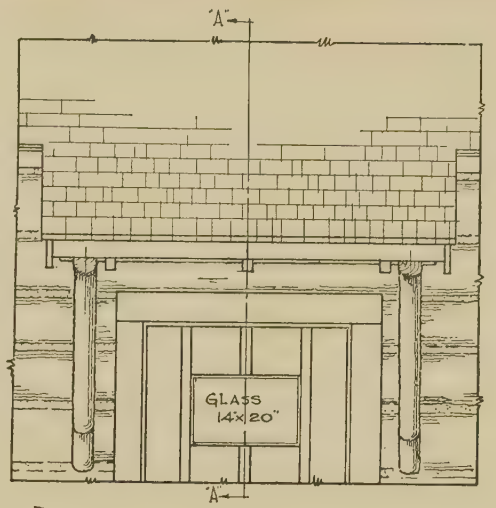


NOTE - ALL DIMENSIONS ARE TAKEN FROM OUTSIDE STUD LINE TO CENTER OF PARTITIONS

FIRST FLOOR PLAN
SCALE 1/4"=1'-0"

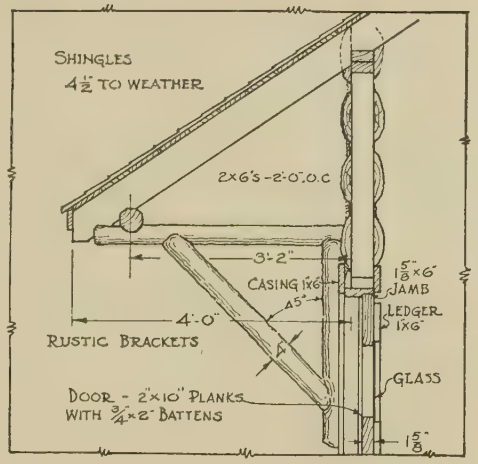


DORMITORY & ROOF PLAN
SCALE 1/4"=1'-0"

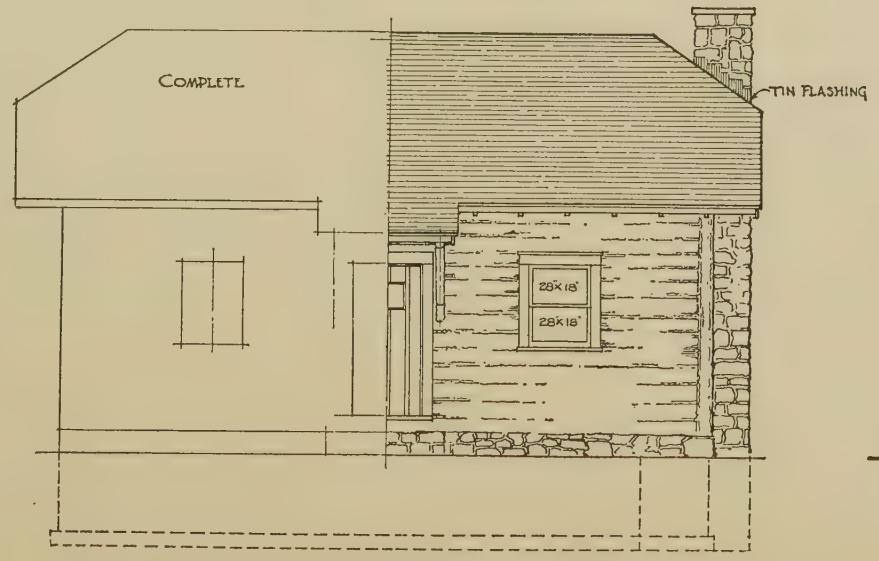


DETAIL · OF · DOOR · AND · HOOD
SCALE $\frac{3}{4}$"=1'-0"

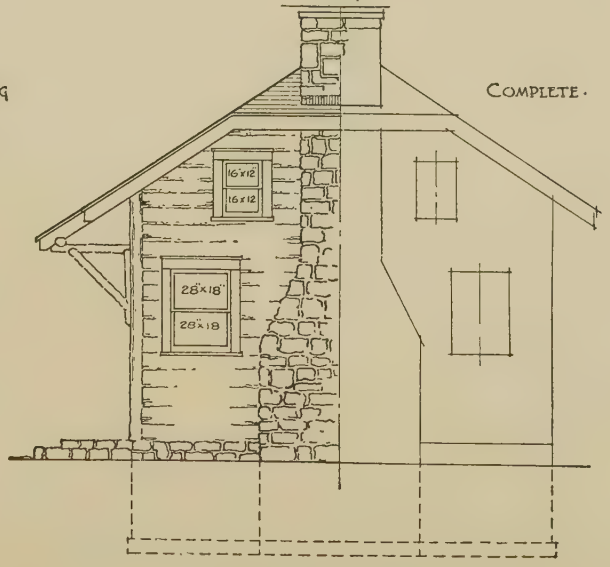
BOY - SCOUT CABIN FOR TROOP SIX



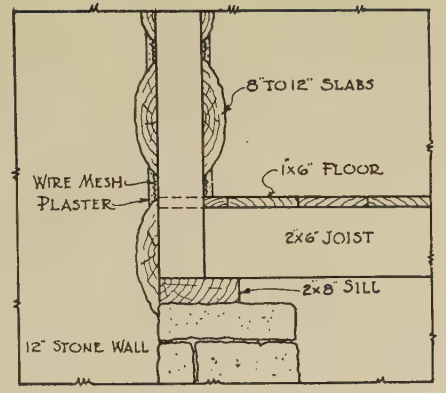
SECTION · A·A
SCALE $\frac{3}{4}$"=1'-0"



FRONT · ELEVATION
SCALE ¼"=1'-0"

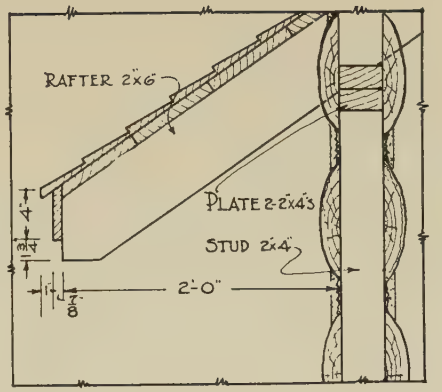


RIGHT · SIDE · ELEVATION
SCALE ¼"=1'-0"

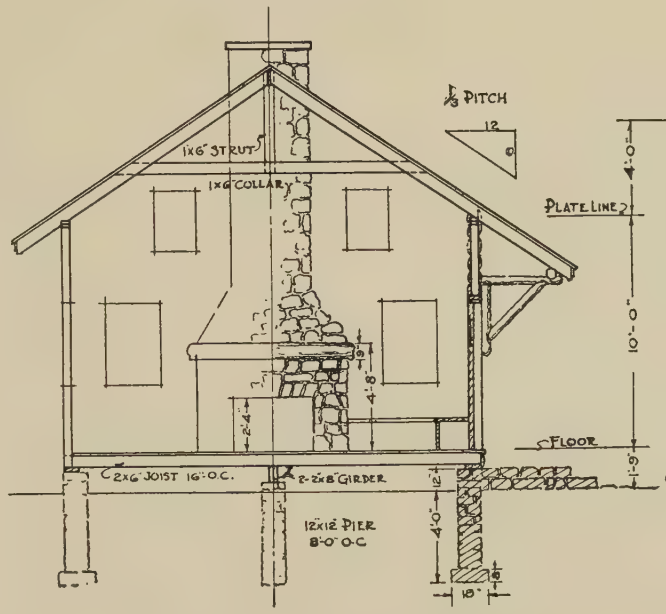


DETAIL · OF · SILL
SCALE 1½"=1'-0"

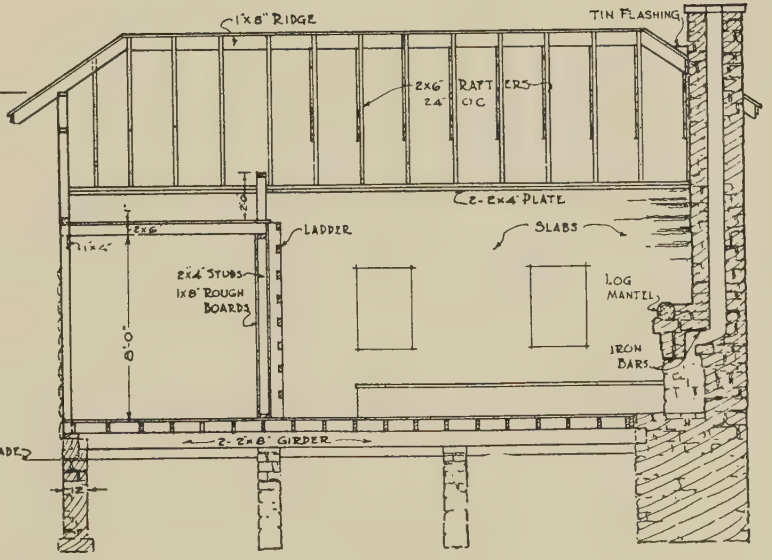
BOY · SCOUT CABIN · FOR TROOP-SIX ·



DETAIL OF CORNICE
SCALE-1½"=1'-0"



CROSS · SECTION · ON · A-A
SCALE ¼"-1'-0"



LONGITUDINAL SECTION · ON · B B
SCALE ¼"=1'-0"

PROBLEM 17—FOUR-ROOM BUNGALOW

(PLATES 28, 29 AND 30)

The four-room bungalow illustrated is typically Colonial. It is designed for a Southern or Southwestern climate. It has no basement, and ventilation is secured by means of iron grills in the foundation walls. It is a compact, small plan. The alternate scheme is a typically English cottage, having a floor plan similar to the first design.

It is planned for a Northern climate with an excavated basement. It will be noted that the plan is somewhat wider, making the living and dining rooms larger and adding to the accessibility of the bath room.

Given: A complete first-floor plan, and foundation plan, a large-scale detail of the front elevation, a part section, and suggested elevations with details.

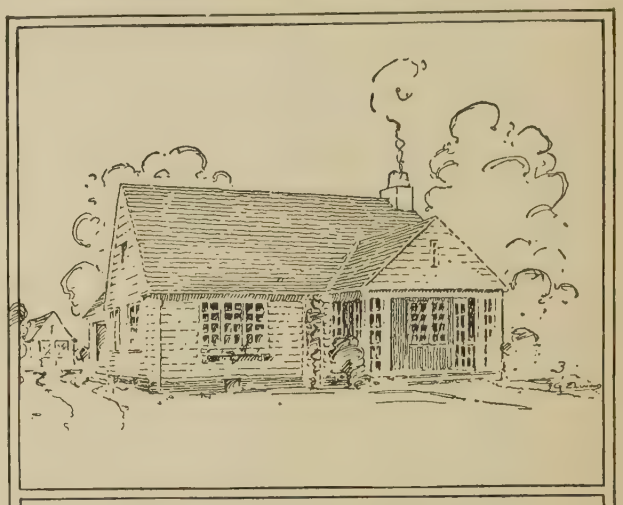
Required: Draw plans, elevations and details as given, or substituting the alternate plan, make elevations and details to fit in Colonial or English styles.

Procedure: Plans should be drawn first but not made final until the elevation sheets are blocked in. The student should always bear in mind the relation of the plan to the elevation and section. He must learn to visualize the house as a whole instead of in two dimensions, as he sees it on his drawing board.

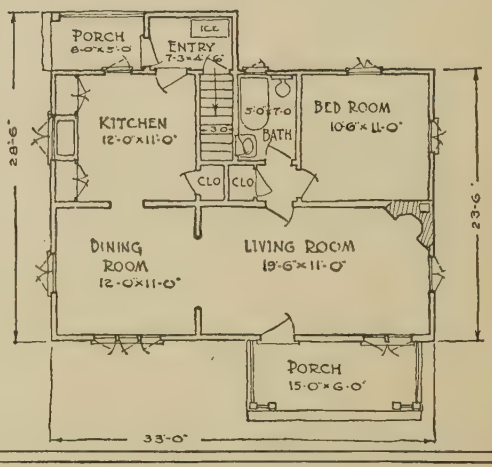
Therefore, one sheet should never be entirely completed until the other sheets of elevations and details are carried out to a similar stage.

In no case should any of the sheets be inked or traced until all are completed in pencil and carefully checked.

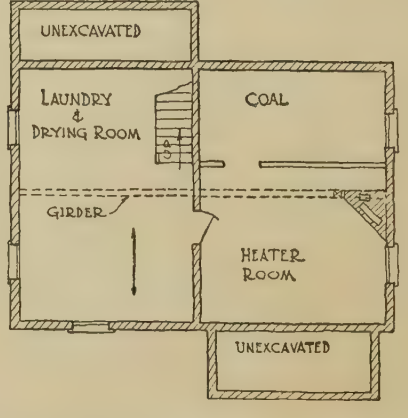
Before making the ¼″ scale elevations, it would be best to draw the ½″ scale elevation and detail, in order to understand the construction. For the dormer window, see Art. 41 and Fig. 28. Also, for porches, see Art. 47 and Fig. 31. For fireplaces see Art. 65, Plate 7 and Fig. 40.



ALTERNATE-ENGLISH-DESIGN

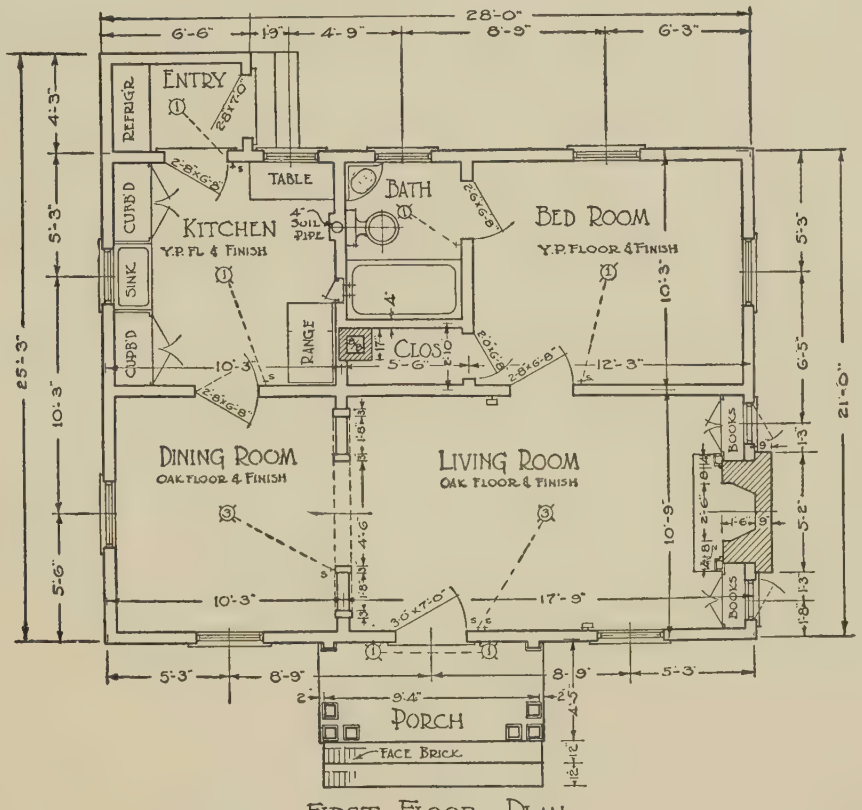


FIRST FLOOR PLAN

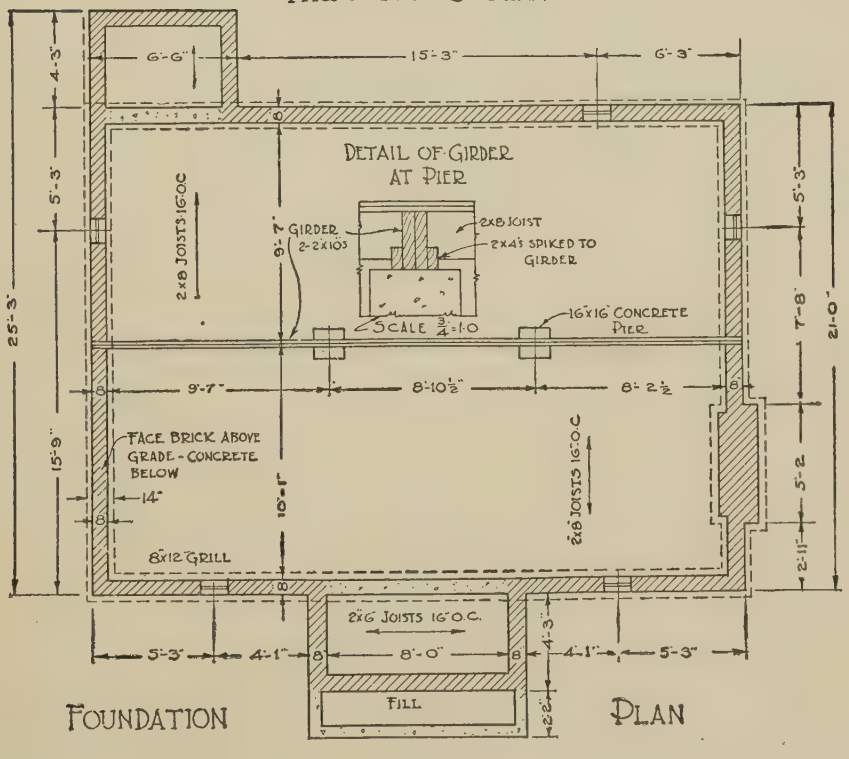


BASEMENT PLAN

FOUR-ROOM BUNGALOW



FIRST FLOOR PLAN



FOUNDATION PLAN

PLATE 28

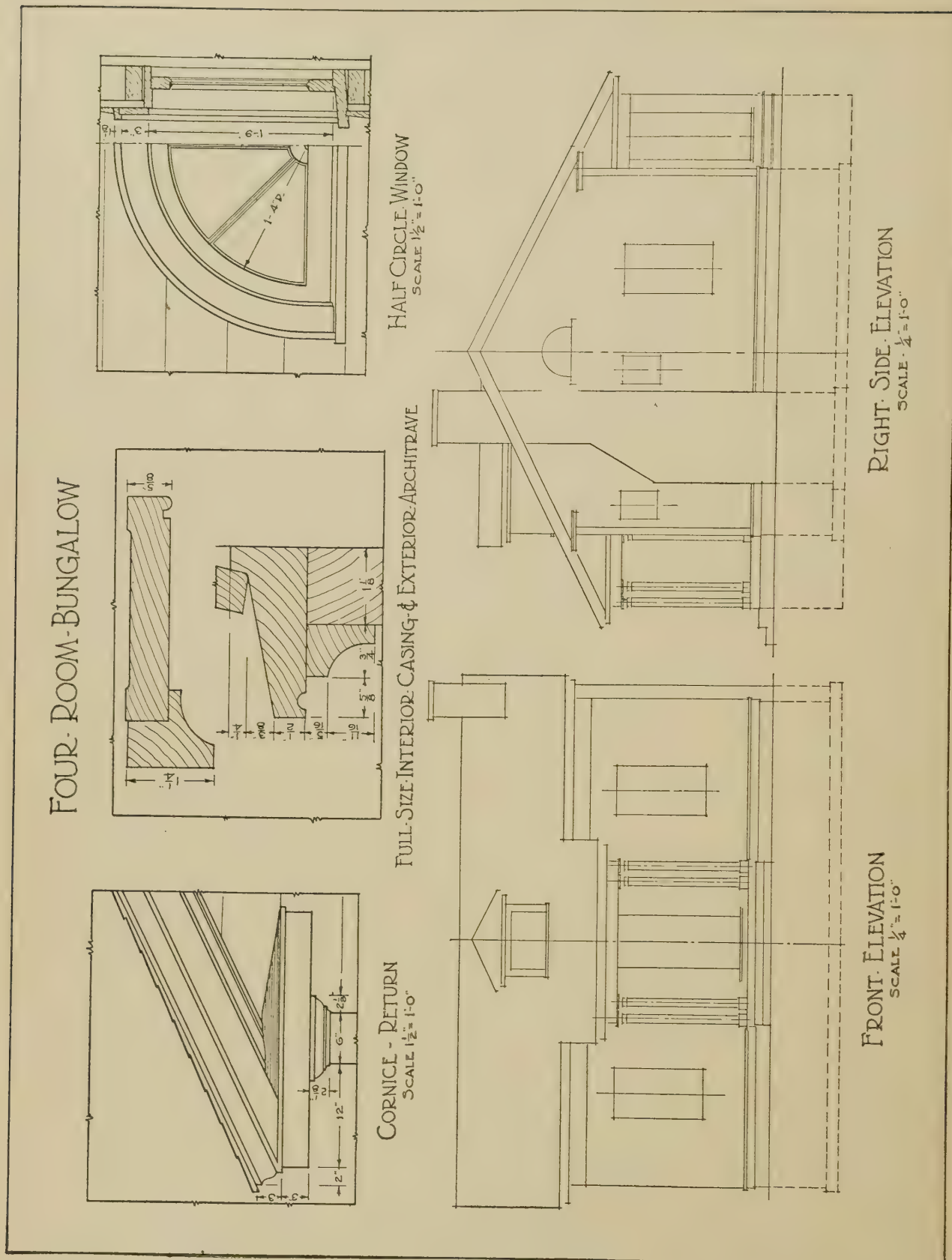

FOUR-ROOM-BUNGALOW
HALF CIRCLE WINDOW
SCALE 1½" = 1'-0"
FULL-SIZE INTERIOR CASING & EXTERIOR ARCHITRAVE
CORNICE - RETURN
SCALE 1½" = 1'-0"
RIGHT SIDE ELEVATION
SCALE ¼" = 1'-0"
FRONT ELEVATION
SCALE ¼" = 1'-0"

PLATE 29

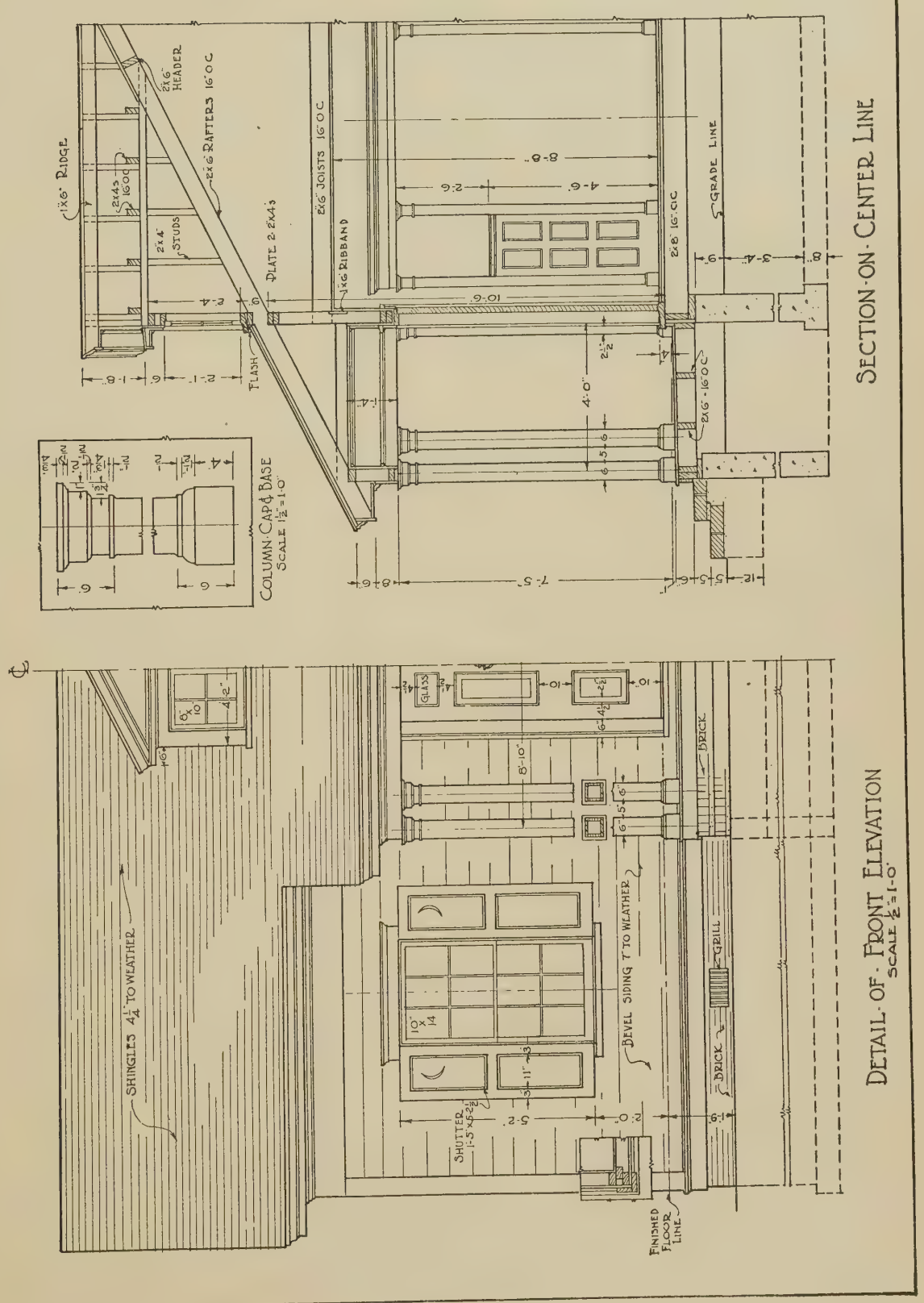
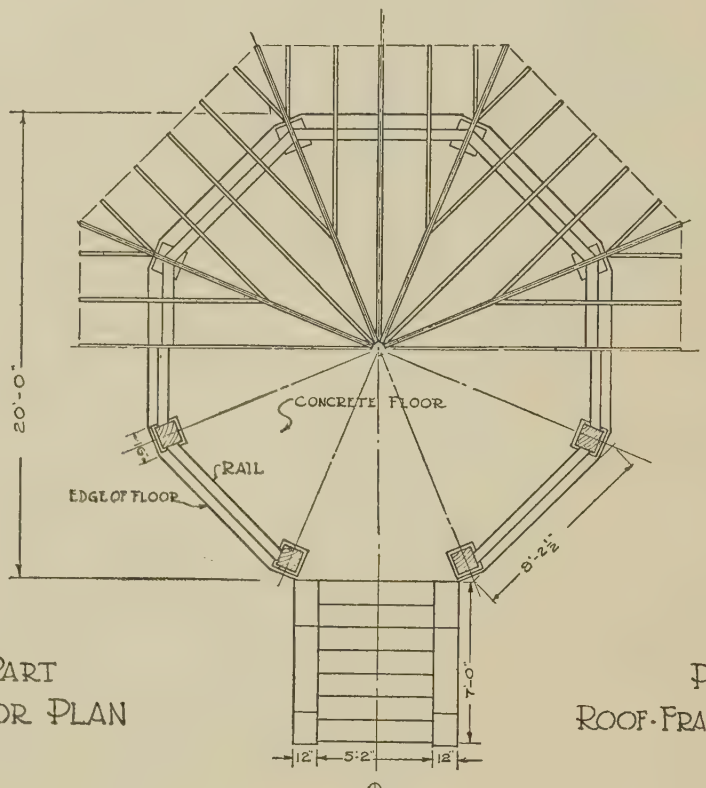

FOUR-ROOM-BUNGALOW
SECTION-ON-CENTER LINE
1x6 RIDGE
2x6 HEADER
2x6 RAFTERS 16 O.C.
2x4 STUDS
2x4s 16 O.C.
PLATE 2-2x4s
2x6 JOISTS 16 O.C.
1x6 RIBBAND
2x8 16 O.C.
GRADE LINE
2x6 - 16 O.C.
FLASH
COLUMN CAP & BASE
SCALE 1½" = 1'-0"
DETAIL OF FRONT ELEVATION
SCALE ½" = 1'-0"
SHINGLES 4½" TO WEATHER
BEVEL SIDING 7" TO WEATHER
BRICK
GRILL
GLASS
SHUTTER
FINISHED FLOOR LINE

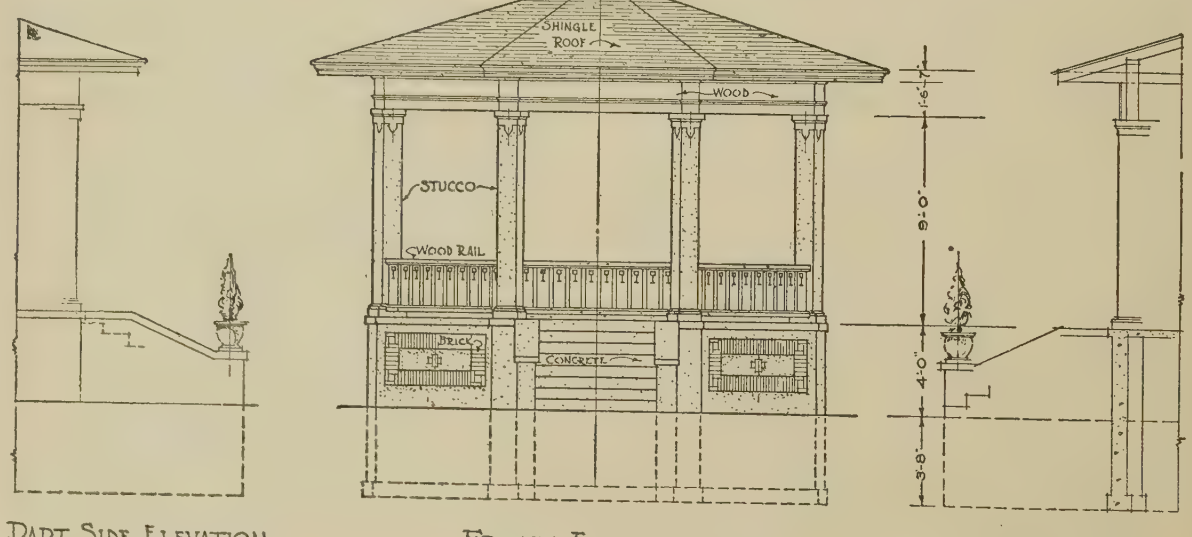
PLATE 30

BAND · STAND.



PART
FLOOR PLAN

PART
ROOF · FRAMING · PLAN



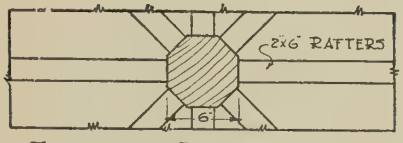
PART · SIDE · ELEVATION
COMPLETE

FRONT · ELEVATION
SCALE · ¼"=1'-0"

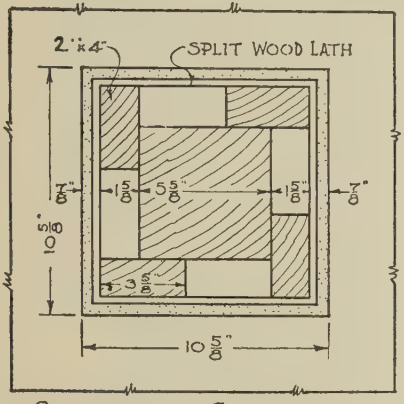
SECTION
COMPLETE

PLATE 31

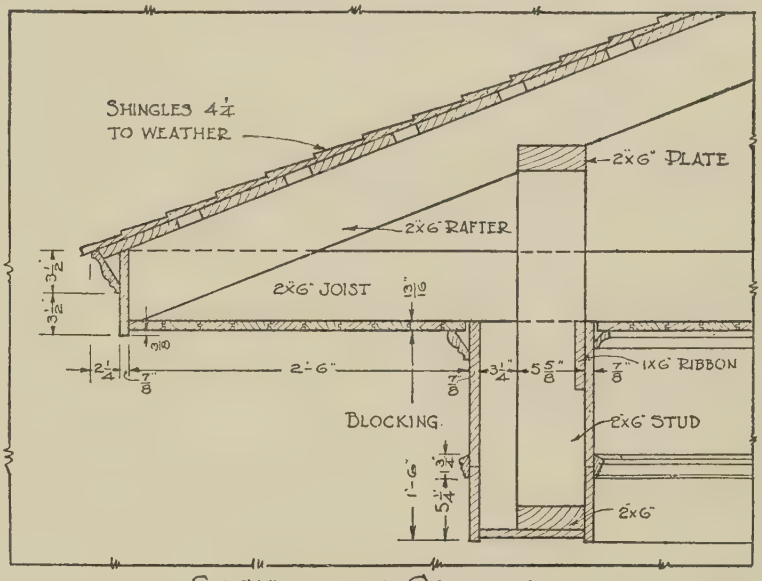
BAND·STAND·DETAILS



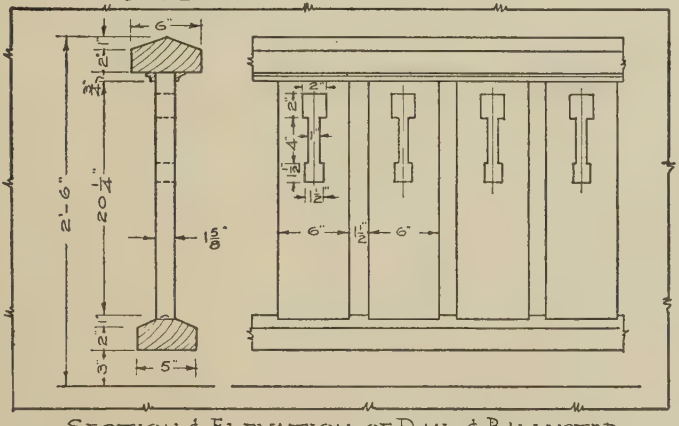
FRAMING·AT·BASE·OF·FLAGPOLE



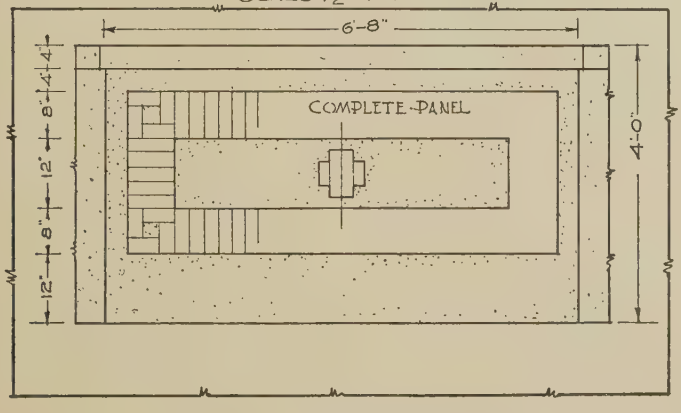
SECTION·OF·COLUMN –
SCALE 3"=1'-0"



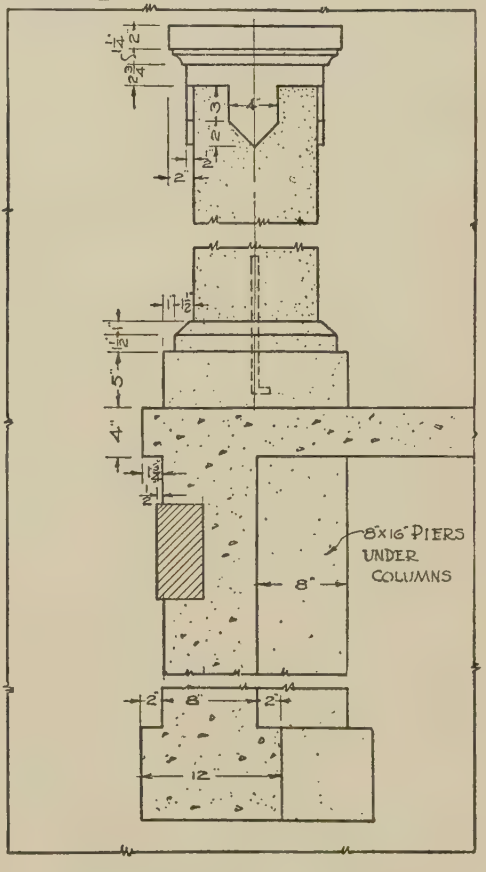
SECTION·OF·CORNICE
SCALE 1½"=1'-0"



SECTION·&·ELEVATION·OF·RAIL·&·BALLUSTER
SCALE 1½"=1'-0"



ELEVATION·OF·BRICK·PANEL
SCALE ¾"=1'-0"



COLUMN·AND·WALL·SECTION·
SCALE 1½"=1'-0"

PROBLEM 18—BAND STAND

(PLATES 31 AND 32)

The octagonal band stand offers a good problem in drafting as well as in construction.

The floor is a reinforced concrete slab supported on concrete foundation walls. The columns, which have a pre-cast concrete base, are built up with a stucco or "Kellastone" surface over split wood lath. For cheaper construction a dressed-and-matched plank floor may be substituted in place of the concrete slab.

Given: Part floor and roof framing plans. Complete front elevation and partial side and section views, also a complete detail sheet.

Required: Plan and elevations as shown completing views in detail, also draw detail sheet as given. Four sheets may be made of this problem by placing the plan, elevation and section each on a separate sheet at a large scale.

PROBLEM 19—RURAL SCHOOL HOUSE

(PLATES 33, 34, 35 AND 36)

The design of an ideal rural school affords a problem that not only requires thought and study, but it may also lead to community betterment. The school may be and often is the center of rural social life; therefore, a well-designed building with a beautiful setting will not only add to but it will reflect the life of that community.

There are a number of factors to consider in school design, the most important being heating, ventilation, lighting and sanitation. Schools must conform to the state laws. For example, all main exit doors must open out. Size of classroom should allow a minimum of 16 square feet of floor space per student and not less than 200 cubic feet of air space. Modern class rooms have five rows of seats and six, seven or eight seats to the row, seating thirty, thirty-five or forty pupils and requiring a room 20′ to 23′ wide and 27′ to 32′ long. Standard ceiling height is 12′ clear. Lighting from one side is the most desirable, North light being best for the eyes. High windows at the rear of the room provided with shades help with the ventilation on hot days and provide additional light on gloomy ones. Window area should be about ⅕ of the floor area. Windows are 3 to 4 feet from the floor and should extend up close to the ceiling to assist ventilation.

The plan illustrated has many excellent features. From the teacher's desk practically all parts of the rooms are visible. Sash doors to the domestic science room and the library make these rooms readily supervised from the teacher's position. The fuel room is convenient to the heater. The teacher's room provides a place for her personal belongings. If desired, the basement may be excavated, stairs provided and a manual training room or play room and the heater placed below.

Given: First floor plan, front and side elevations and section.

Required: Draw plan as given or change to place heater in basement. Complete front elevation. Draw both side elevations, rear elevation and section. Scale ¼″ = 1′ 0″.

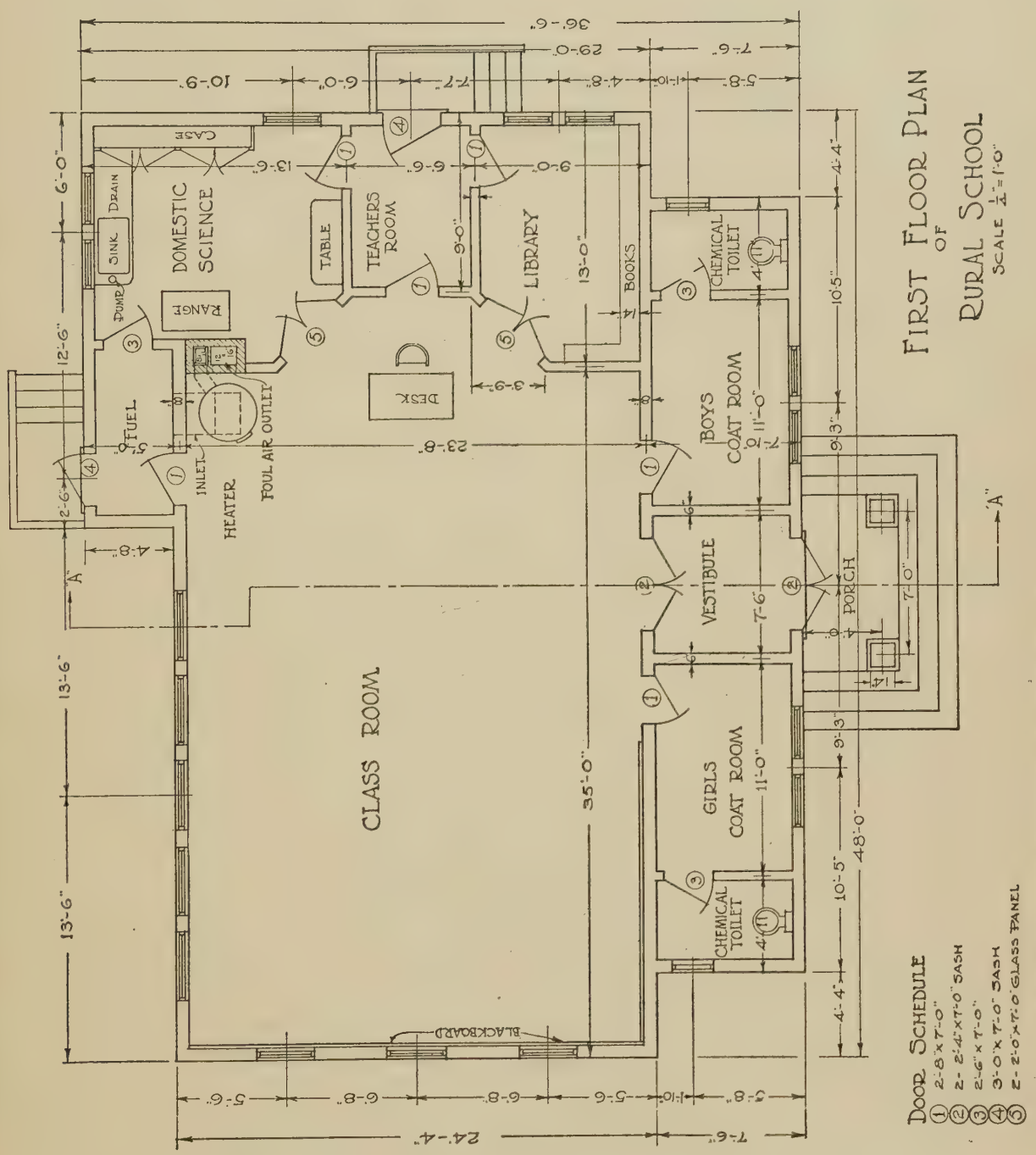
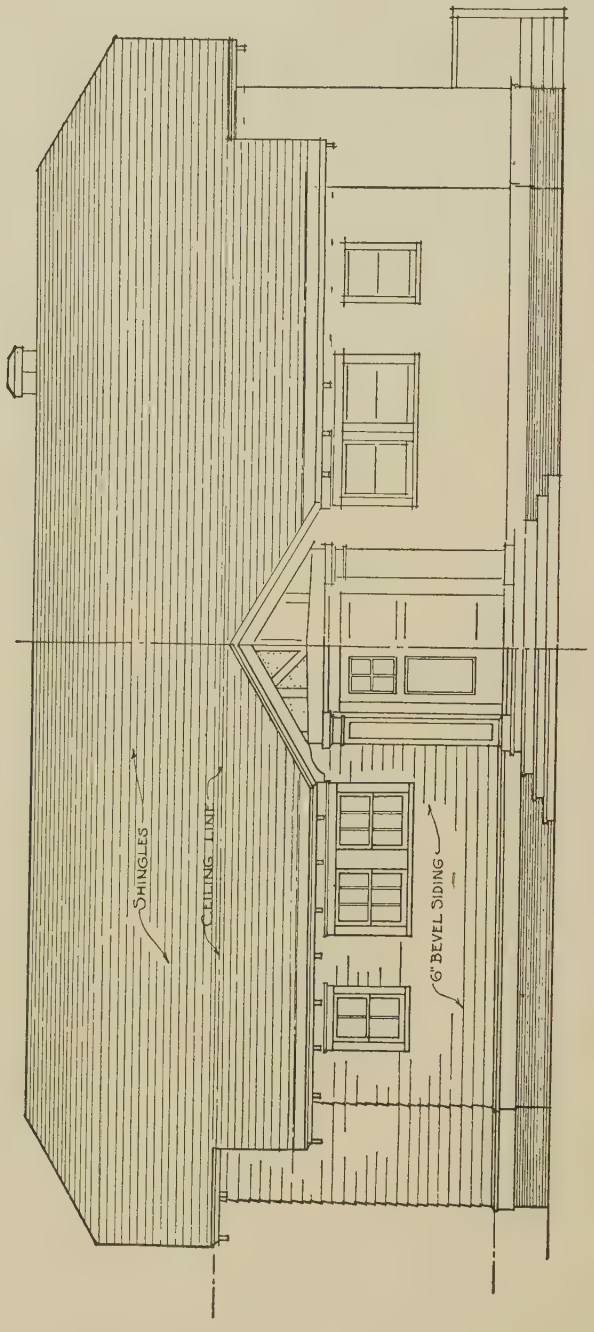

FIRST FLOOR PLAN
OF
RURAL SCHOOL
SCALE 1/4"=1'-0"
DOMESTIC SCIENCE
CASE
SINK
DRAIN
PUMP
RANGE
TABLE
TEACHERS ROOM
LIBRARY
BOOKS
CHEMICAL TOILET
DESK
FUEL
INLET
HEATER
FOUL AIR OUTLET
BOYS COAT ROOM
VESTIBULE
PORCH
CLASS ROOM
GIRLS COAT ROOM
BLACKBOARD
DOOR SCHEDULE
1 2'-8"x7'-0"
2 - 2'-4"x7'-0" SASH
2'-6"x7'-0"
3'-0"x7'-0" SASH
2 - 2'-0"x7'-0" GLASS PANEL

PLATE 33



FRONT ELEVATION

PLATE 34

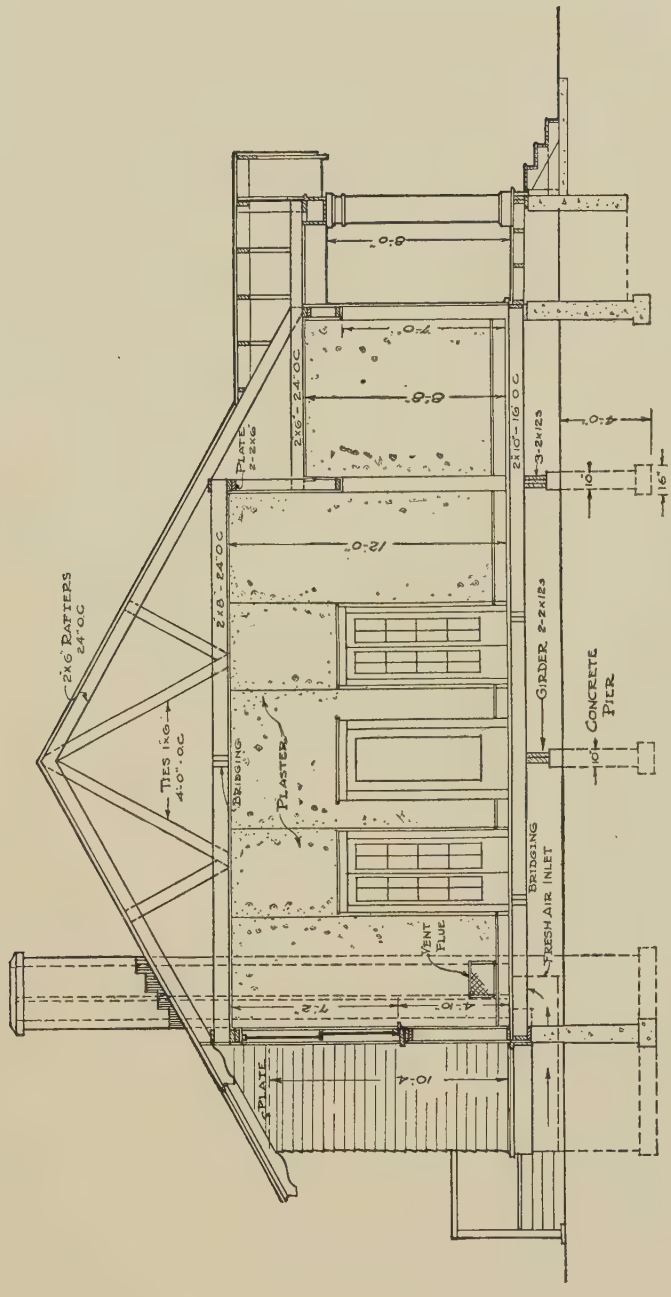
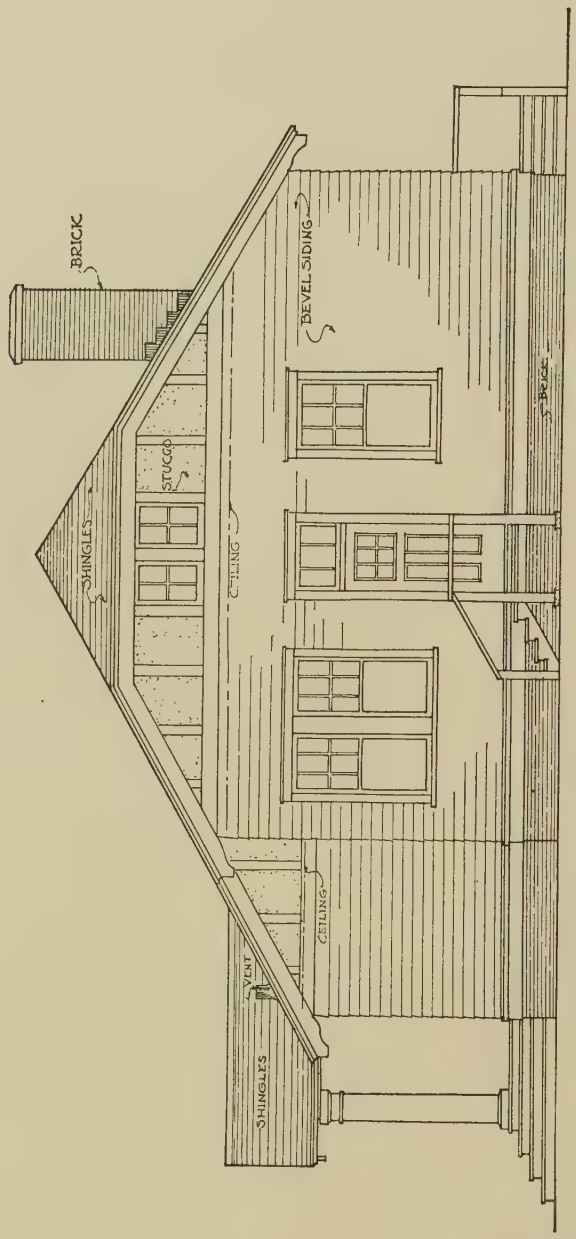

SECTION - ON - "A-A"
2x6 RAFTERS 24" O.C.
TIES 1x6 4'-0" O.C.
2x6 - 24" O.C.
PLATE 2-2x6
2x6 - 24" O.C.
2x10 - 16" O.C.
3-2x12's
BRIDGING
PLASTER
GIRDER 2-2x12's
CONCRETE PIER
BRIDGING
FRESH AIR INLET
VENT FLUE
PLATE
0'-8"
7'-0"
8'-8"
0'-21"
7'-2"
4'-0"
10"
16"

Plate 35



SOUTH - SIDE ELEVATION

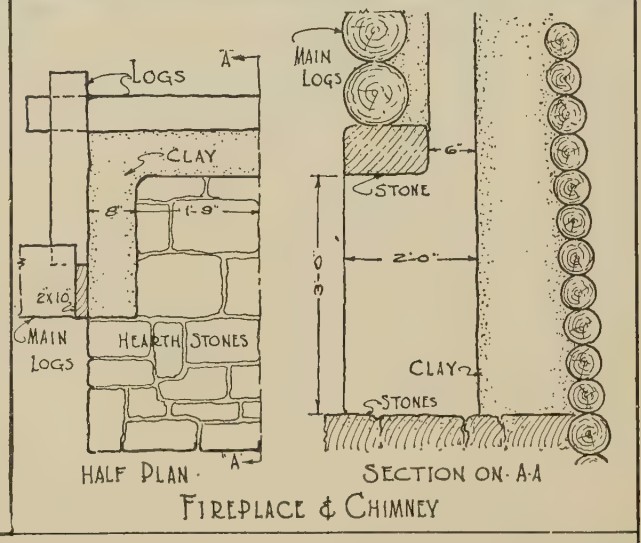
PLATE 36

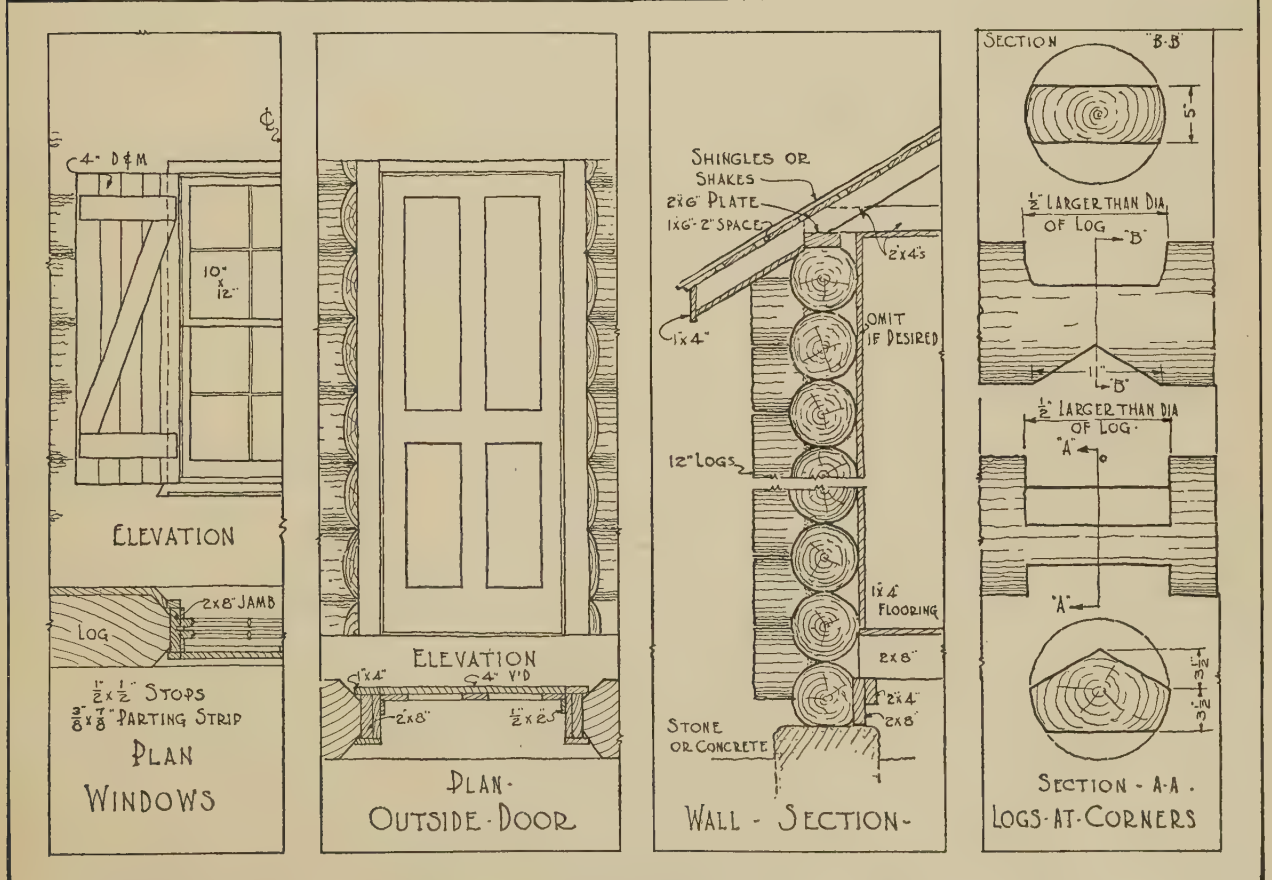
PROBLEM 20—**LOG CABIN**

The log cabin is suitable for summer camps and cottages when located where there is a plentiful supply of timber, and where it is comparatively cheap.

The cost of hauling in lumber and other building materials is often prohibitive, especially, where the camp is located at a considerable distance from the railroad or sawmill. Then, too, the log cabin appeals to the romantic and has more charm for the city dweller on his only too brief vacation. The details illustrated are recommended by the U. S. Department of Engineering for the construction of forest rangers' cabins.

Required: Draw floor and footing plans. The floor plan is limited in size to the length of logs readily obtainable. Draw front and end elevations, sections and details. Scale, $\frac{1}{4}'' = 1'\ 0''$.





Group III

PROBLEM 21—TWO-CAR GARAGE WITH CHAUFFEUR QUARTERS

(Plates 37 and 38)

On many of the larger town or country estates, accommodations for the chauffeur in connection with the garage itself are desired.

The accompanying design with chauffeur's room and bath on the second floor is planned to meet such a requirement. The design is typically Colonial in character.

Given: Complete first and second floor plans, a partial front and a complete side elevation and cross section.

Required: First and second floor plans as given, or change plan, placing work and heater rooms at the rear instead of at the side.

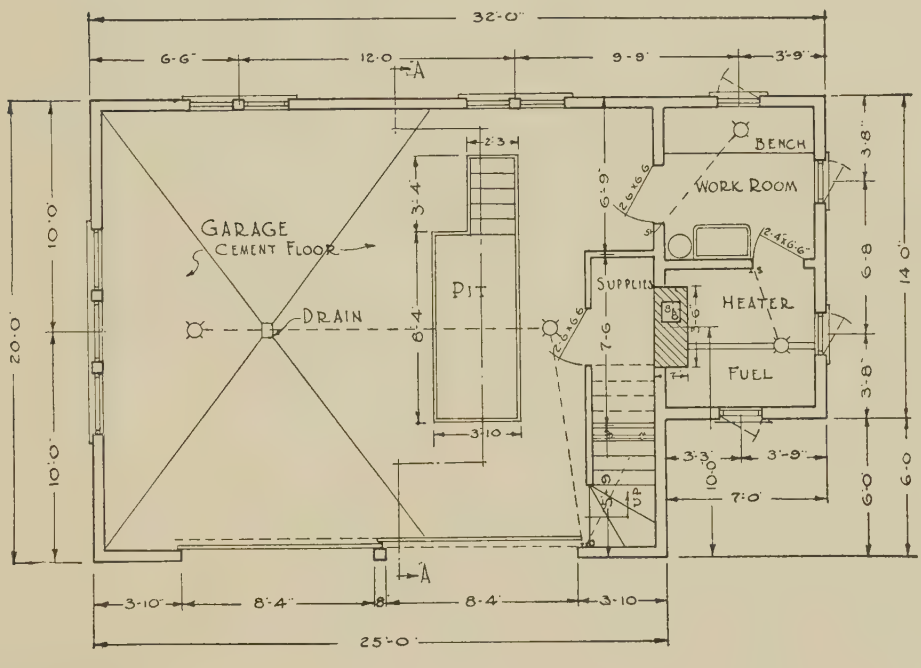
All elevations complete at $\frac{1}{4}''$ scale.

Cross section at $\frac{1}{2}''$ or $\frac{3}{4}''$ scale.

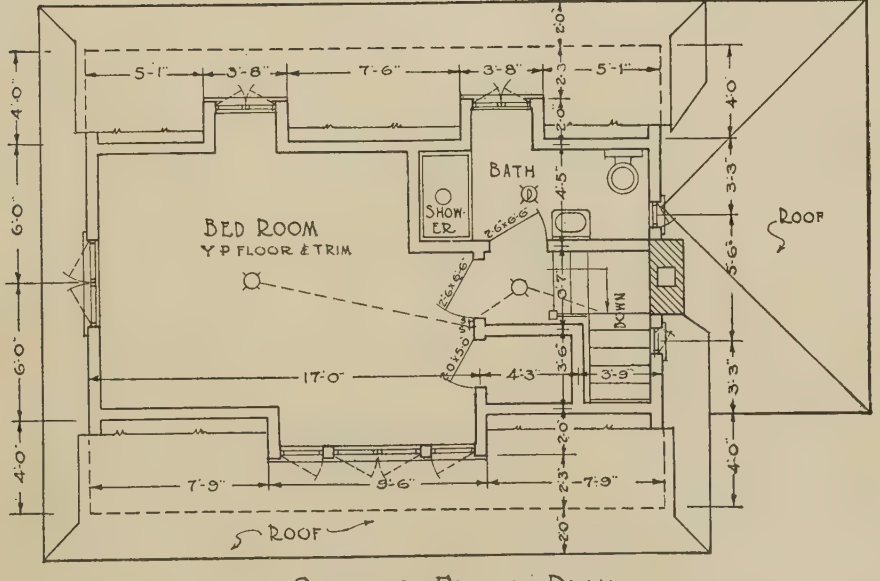
Detail of the dormer at $\frac{3}{4}''$ or $1\frac{1}{2}'''$ to the foot.

Procedure: Similar to previous problems.

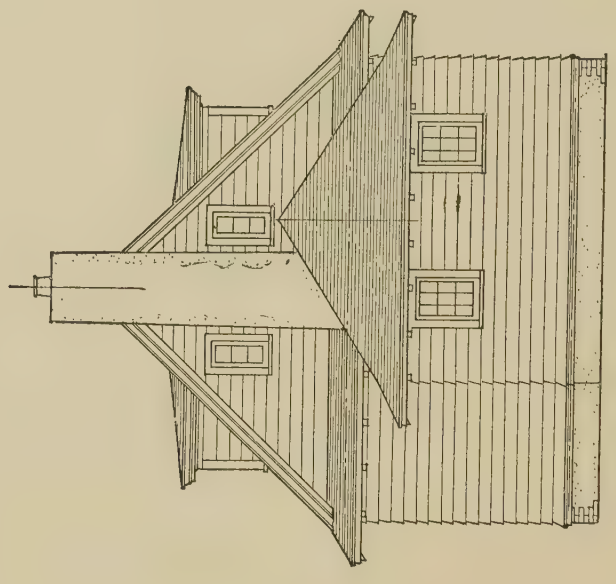
TWO CAR GARAGE



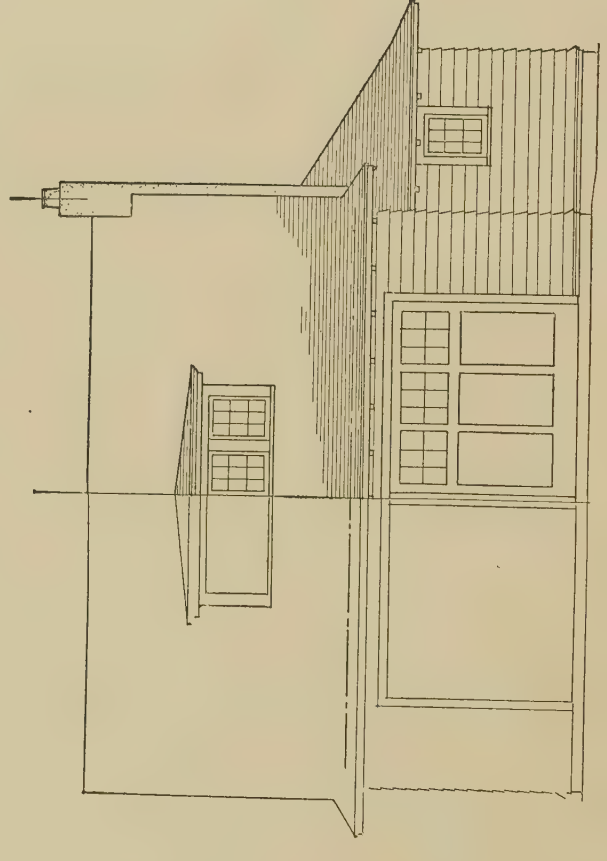
FIRST FLOOR PLAN



SECOND FLOOR PLAN

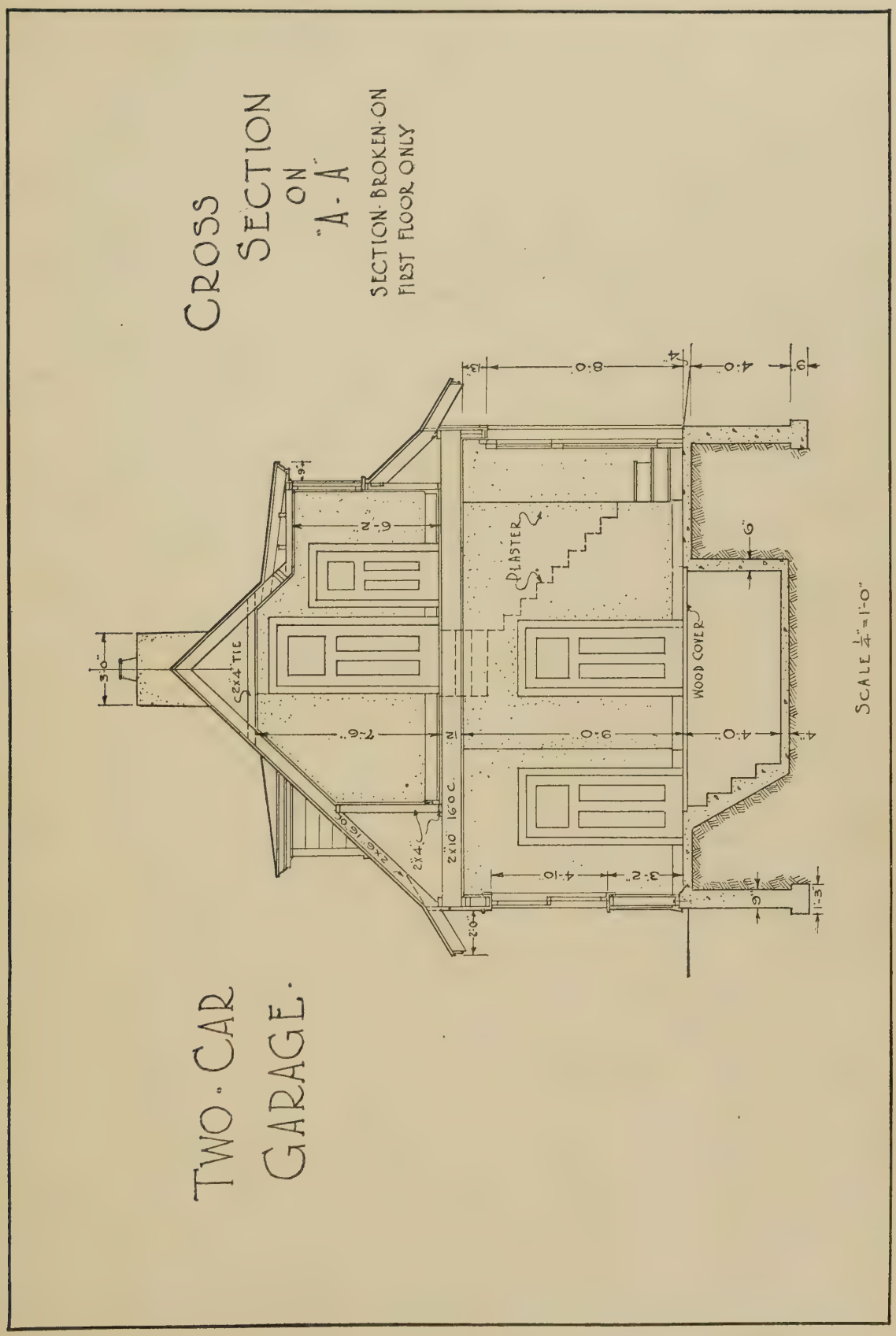


RIGHT · SIDE · ELEVATION



FRONT ELEVATION

TWO CAR GARAGE
WITH
CHAUFFERS QUARTERS
SCALE $\frac{1}{4}$" = 1'-0"


CROSS SECTION ON "A-A"
SECTION BROKEN ON FIRST FLOOR ONLY
TWO-CAR GARAGE.
SCALE 1/4"=1'-0"
PLASTER
WOOD COVER
2X10 16 O.C.
2X4 TIE
2X6 16 O.C.
2X4
8'-0"
4'-0"
6'-2"
9'-0"
4'-10"
3'-2"
3'-0"
2'-0"
1'-3"
6"

PROBLEM 22—**DUTCH COLONIAL HOUSE**

(PLATES 39, 40, 41, 42 AND 43)

The five plates of the Dutch Colonial house, completed and fully dimensioned offer an example to the student in general technic and the placing of dimensions.

Required: An original design by the student of a house of similar size and type to the one given, completing all plans, elevations and details. A complete set of working drawings would include:

(1) Basement plan.
(2) First floor plan.
(3) Second floor plan.
(4) Front elevation.
(5) Right side elevation.
(6) Left side elevation.
(7) Rear elevation.
(8) Details of fireplace.
(9) Details of kitchen and pantry cases.
(10) Details of stairs, trim and medicine cabinet.

If the plates are drawn as given, rearrange the second floor to give three bedrooms and sewing room or one master bedroom and two smaller rooms.

Procedure: Start with the first floor plan, blocking in all of the rooms, but do not complete in detail. Then proceed with second floor plan. If tracings and blue prints are desired, it is best to use transparent tracing paper for both the second floor plan and for the basement. Place the paper over the first floor plan, and trace. Wall outlines, locations of chimneys, soil pipes, bearing partitions, windows, etc., may be located with reference to those on the first floor. All details such as lights, location of furnace, pipes and registers, lettering and dimensioning should be left to the last.

Next, block in the elevations. Draw the front elevation first. Starting with the grade line in the wall section, lay off all story or floor heights, the plate line and window heights.

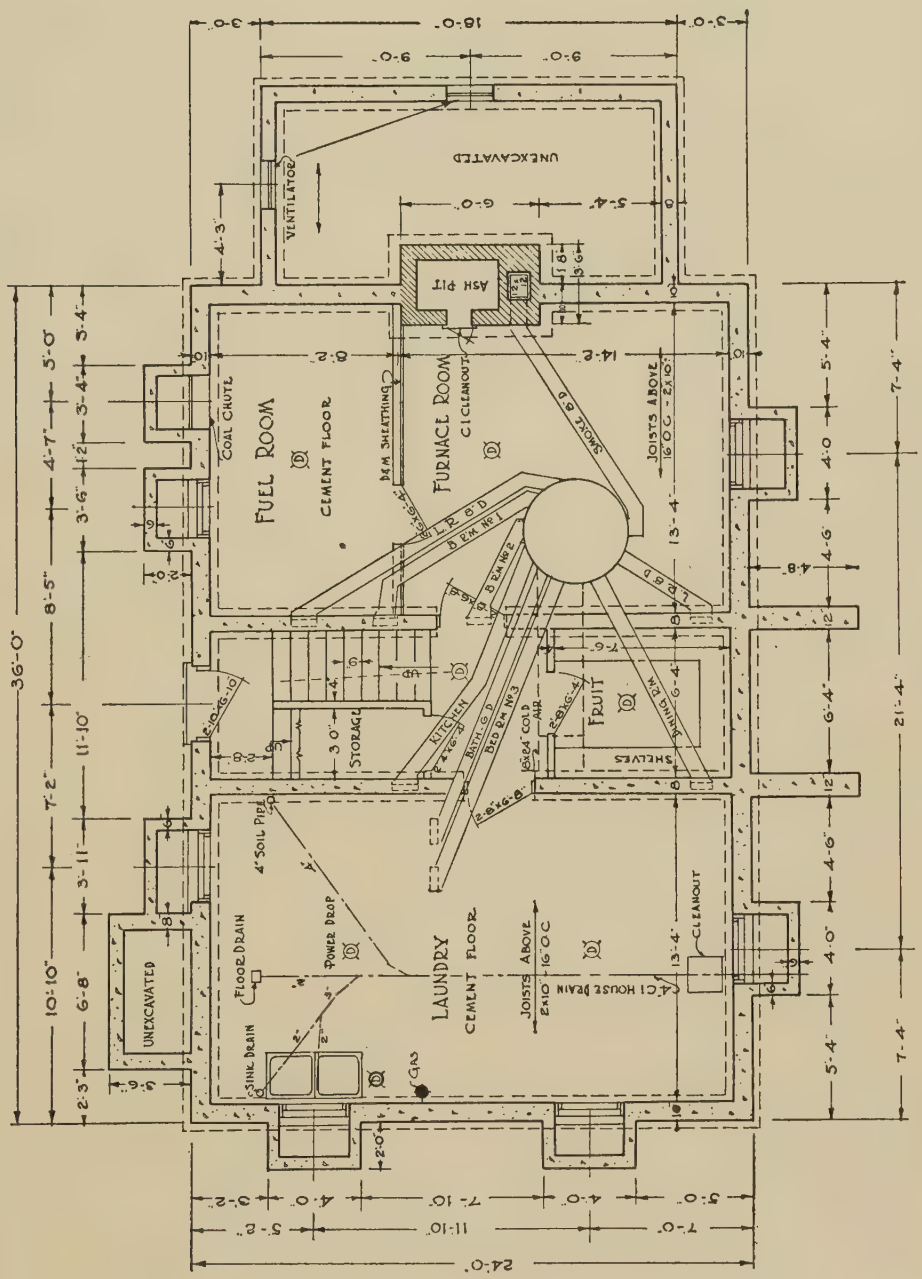
Locate cornice by getting the pitch line of the roof and drawing rafter as described in previous problems.

Draw center lines for all door and window openings to be located according to plan.

Project from wall section to get the height of doors, windows, cornice, roof, etc., then complete in detail.

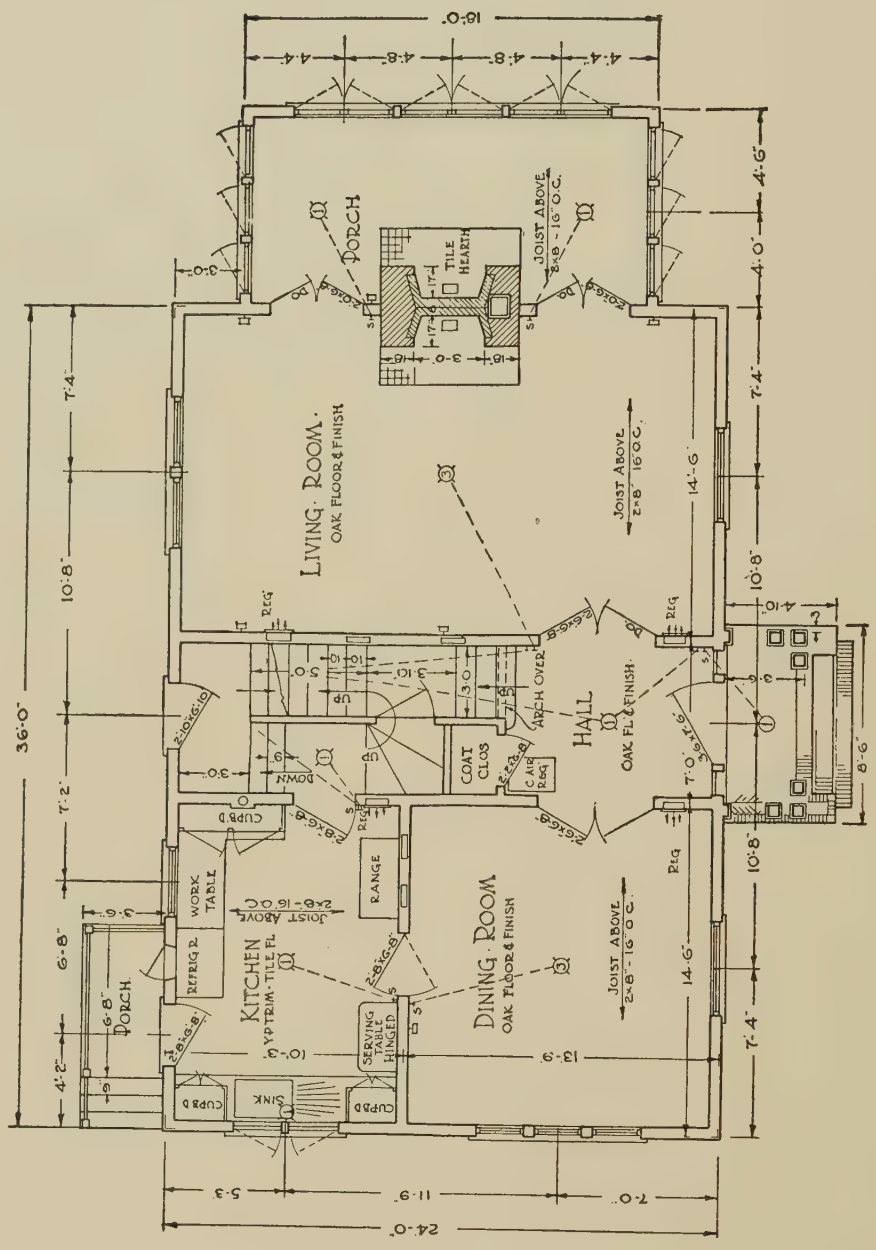
Draw elevations on transparent tracing paper. Reverse side elevation when drawn and trace for the opposite side elevation. If the plan is symmetrical, all of the outlines will be the same.

DUTCH COLONIAL HOUSE



BASEMENT PLAN
SCALE 1/4" = 1'-0"

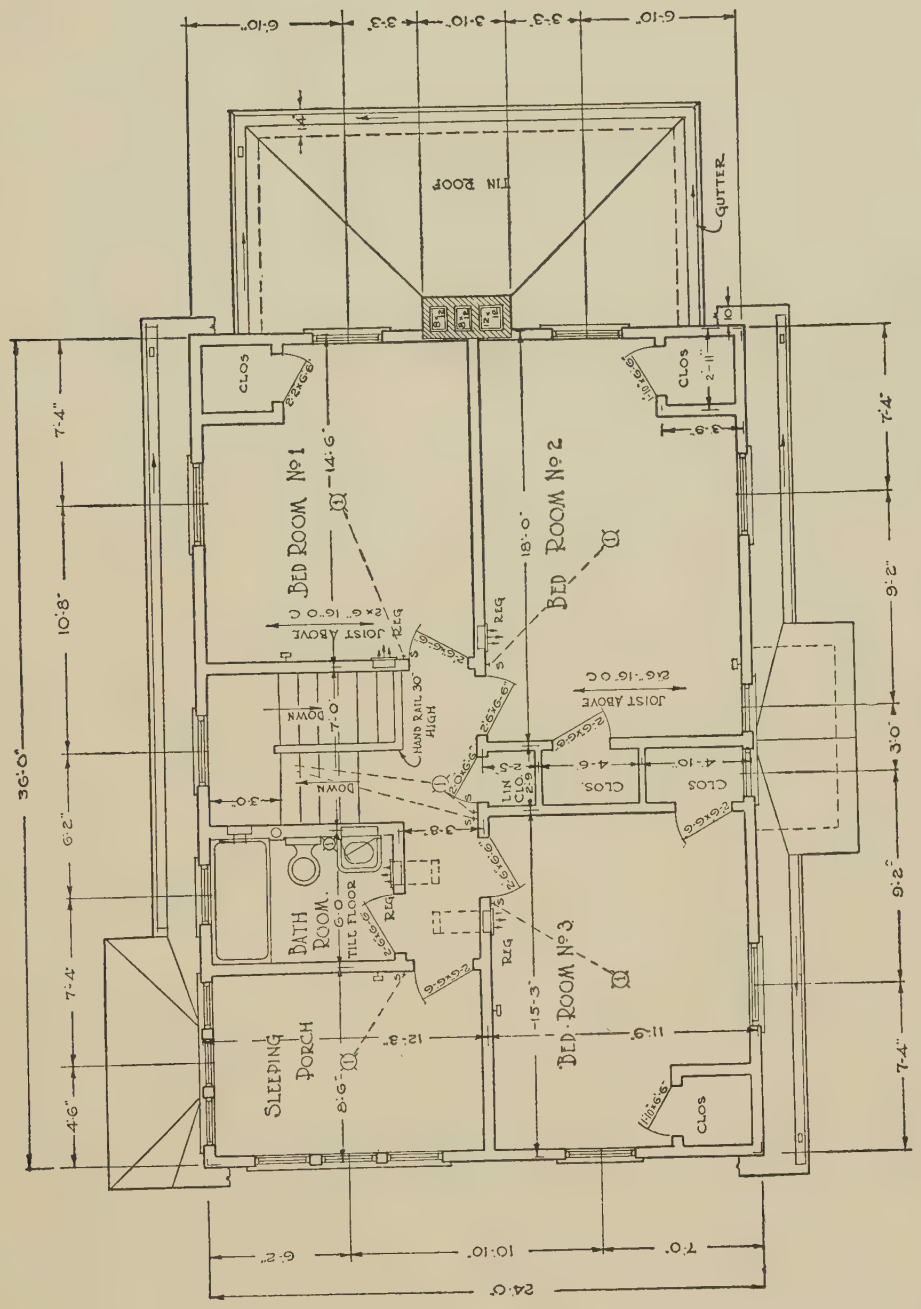
DUTCH COLONIAL HOUSE



FIRST FLOOR PLAN
SCALE - ½"=1'-0"

PLATE 40

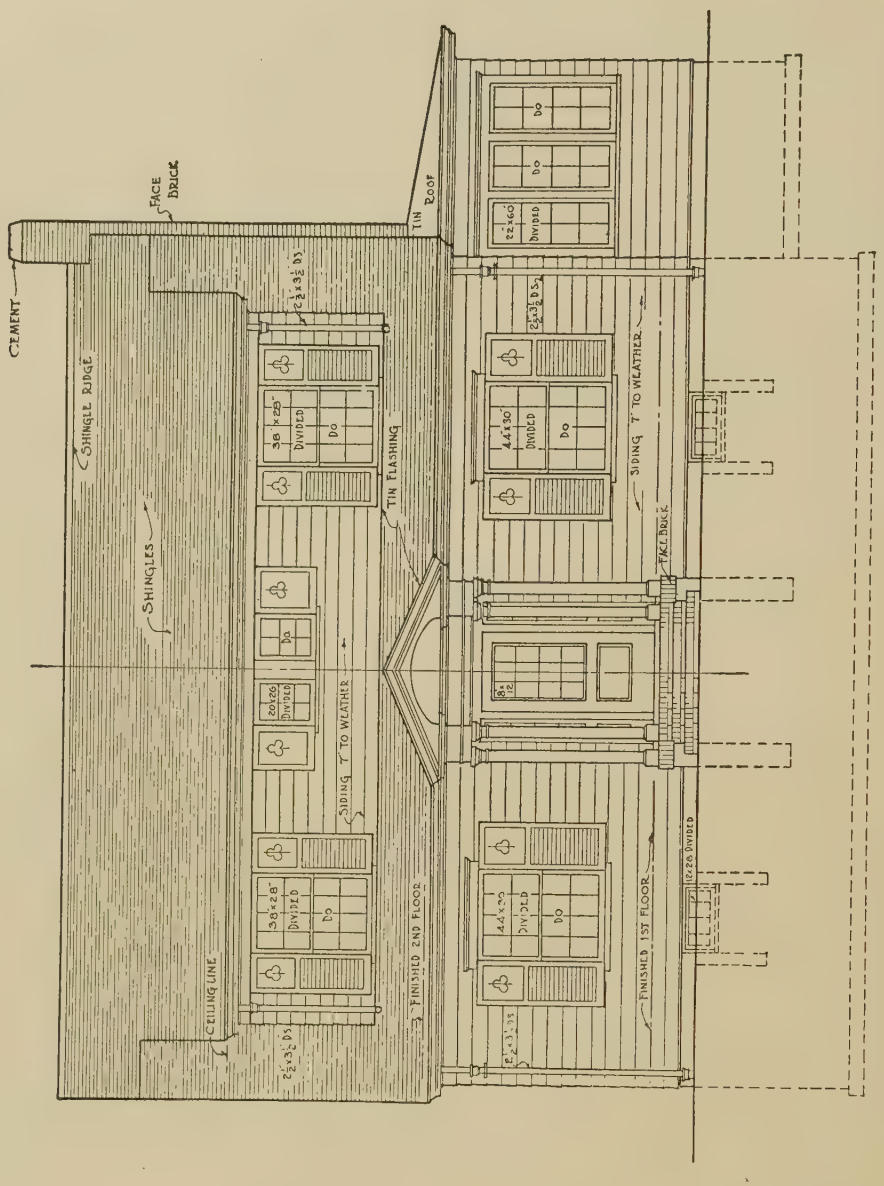
DUTCH COLONIAL HOUSE



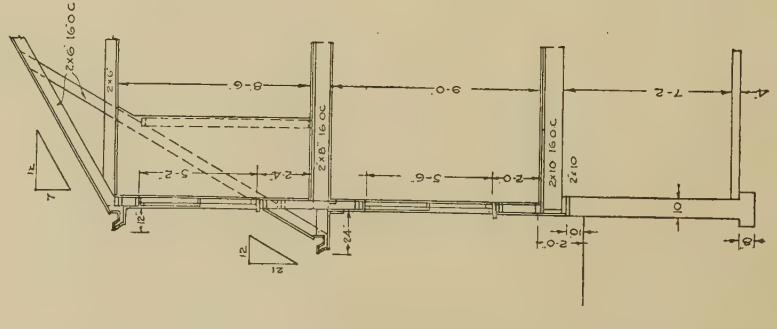
SECOND · FLOOR · PLAN
SCALE 1/4"-1'-0"

PLATE 41

DUTCH COLONIAL HOUSE



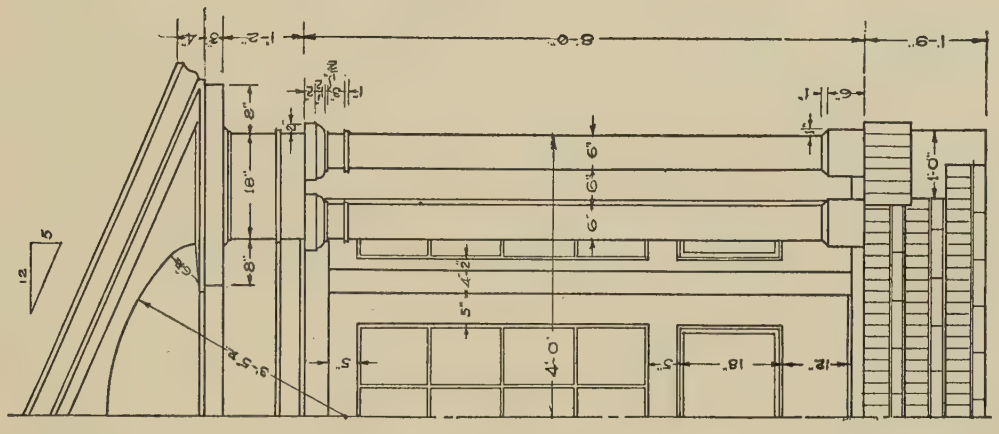
FRONT ELEVATION
SCALE 1/4" = 1'-0"



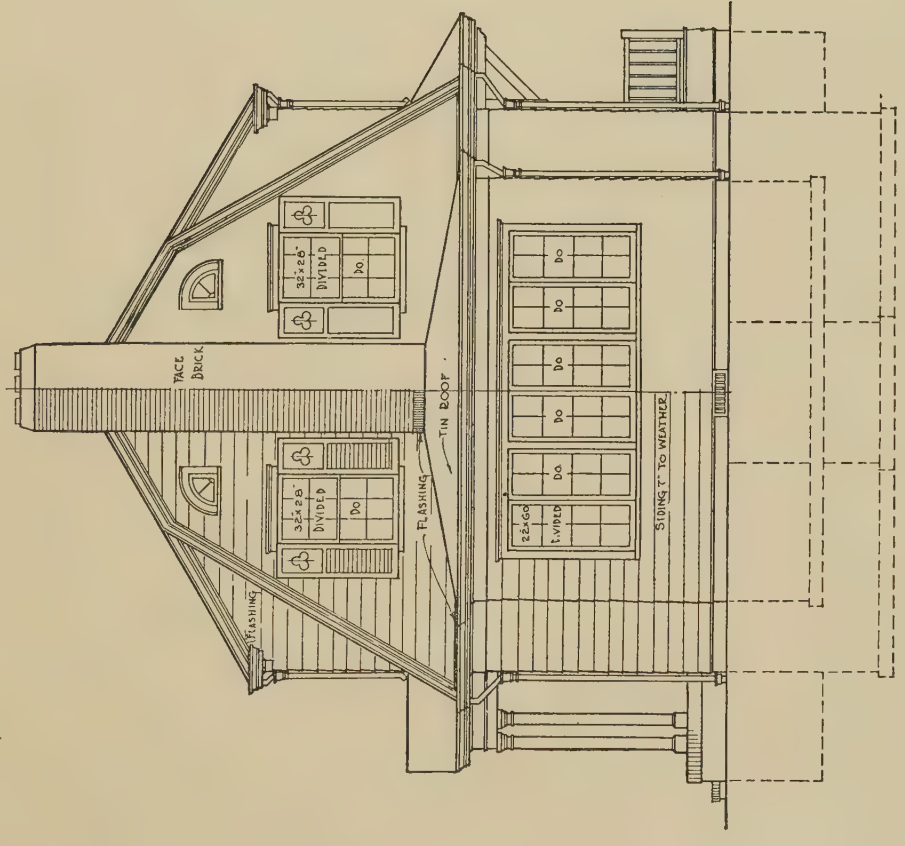
WALL SECTION

PLATE 42

DUTCH COLONIAL HOUSE



ENTRANCE DETAIL
SCALE 3/4"=1'-0"



RIGHT SIDE ELEVATION
SCALE 1/4"=1'-0"

PLATE 43

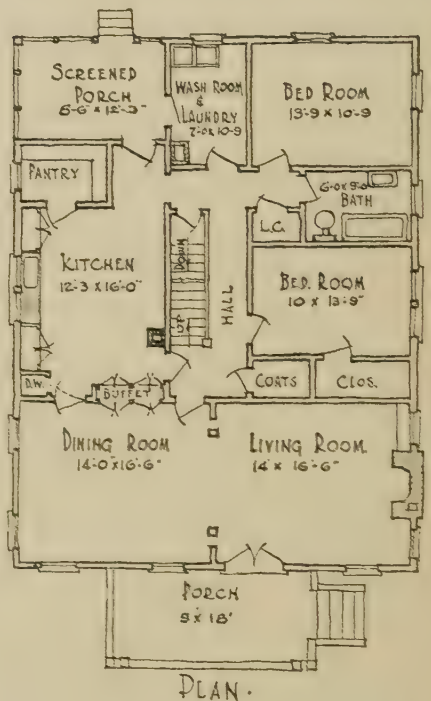
PROBLEM 23—FARM HOUSE

Practically all of the work on the farm is performed in the fields or at the barns, which are located back of the house. For that reason, the farmer and his helpers always enter and leave the house by way of the back door. They wash in the wash-room or laundry and pass in to the dining room or up stairs without going thru the kitchen or living room. The wash-room is an essentially distinctive feature of the farm house. The bath room and bed rooms are convenient to the kitchen as well as to the front of the house. The dining room should be as large if not larger than the living room, since it is often used as a family room, while the living room is a company room. However, the two should be connected with French doors or an arched or cased opening so that the rooms may be thrown in one for the holiday occasion or a big dinner or party.

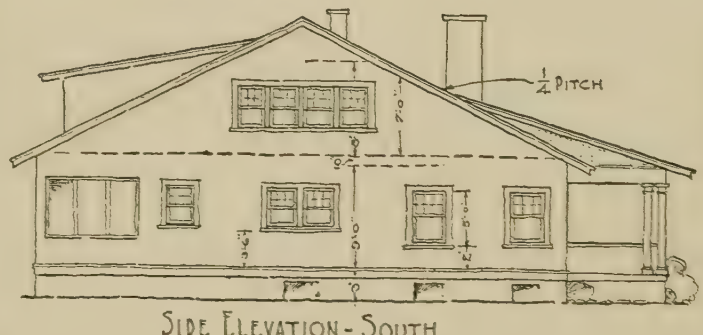
The pantry may be omitted and the space occupied by a breakfast nook, with seats and table. The dumb-waiter serves as a refrigerator where foods may be lowered to the cool basement and easily raised again when needed.

The screened porch at the rear affords a cool place in summer for the housewife to perform many of her duties.

Given: Sketch floor plan, perspective and elevations.



PLAN.



SIDE ELEVATION - SOUTH

FRONT - ELEVATION - EAST.

Required: (1) Draw first floor plan as given at ¼″ scale.

(2) Draw second floor plan providing for at least two bed rooms and either bath or storage space.

(3) Draw basement plan providing for a vegetable room separated from the furnace room by a masonry wall.

(4) Draw the four elevations at ¼″ scale.

(5) Draw details of the fireplace, kitchen cases and arched opening at ¾″ scale, also full size details of door and window casings, base, etc.

Group IV

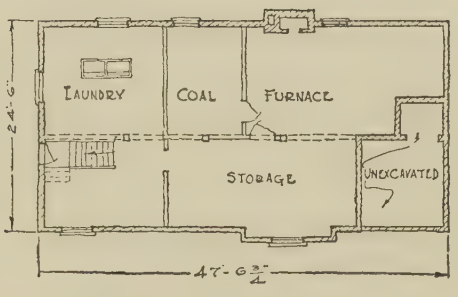
PROBLEM 24—BRICK BUNGALOW

(Plates 44, 45 and 46)

The drawings for a brick structure will differ considerable in detail from those of the typical frame building. These variations are shown in the accompanying plans, elevations and details of a brick bungalow. It will be noted that dimensions are taken from the outside corners to the edge of masonry openings and the clear width of the opening on the outside face of the wall given. The widths of the wall spaces between the windows should be determined, whenever possible, by the lengths of the bricks plus the mortar joints. The heights should also be determined by the number of courses of brick plus the joints. The standard size face brick is 2¼″x3¾″x8″, which is the size adopted by the Face Brick Association. (Art. 59.) The mortar joint in this design is ½″.

Given: Complete first floor plan, front elevation with detail of double-hung window. Three typical wall sections of solid brick, brick veneer on hollow tile and brick veneer on frame, also sketch basement plan, side elevation and perspective.

Required: First floor plan, basement plan, front elevation with details, left side elevation, right side elevation, rear elevation and detail of casement window or of fireplace, using one of the three types of construction illustrated in the wall sections.

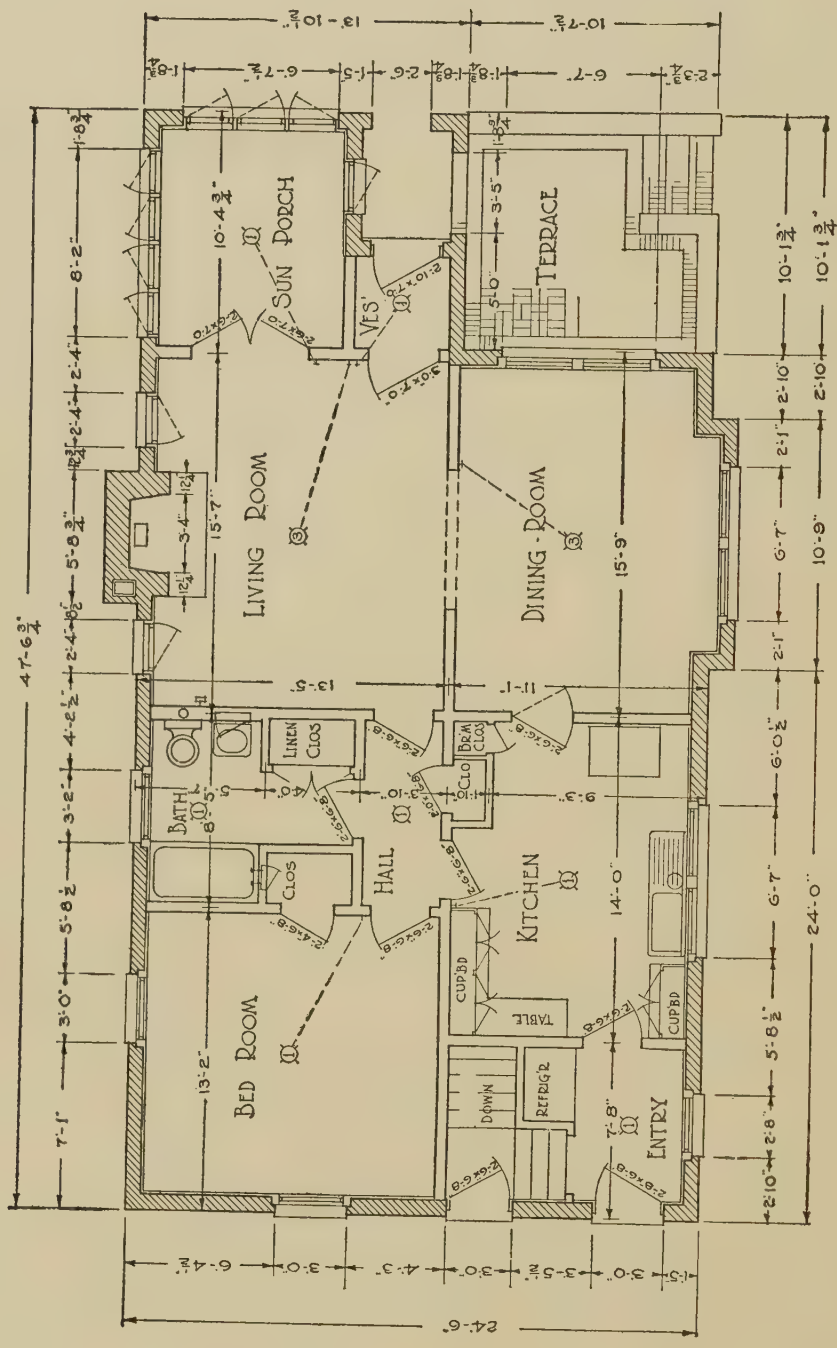


BASEMENT PLAN

LEFT-SIDE ELEVATION

PERSPECTIVE

A · BRICK - BUNGALOW



FIRST · FLOOR · PLAN
SCALE ¼"=1'-0

PLATE 44

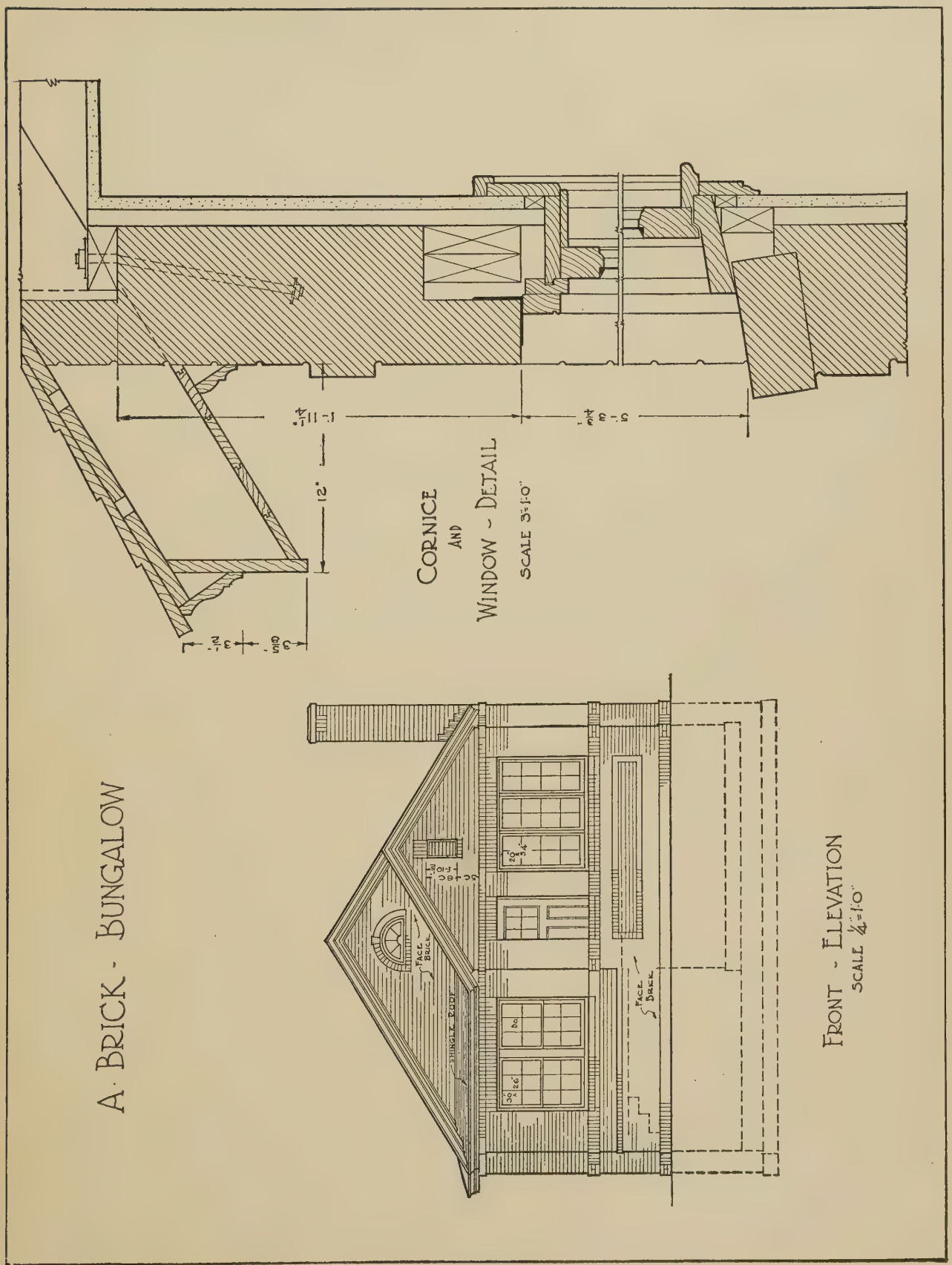
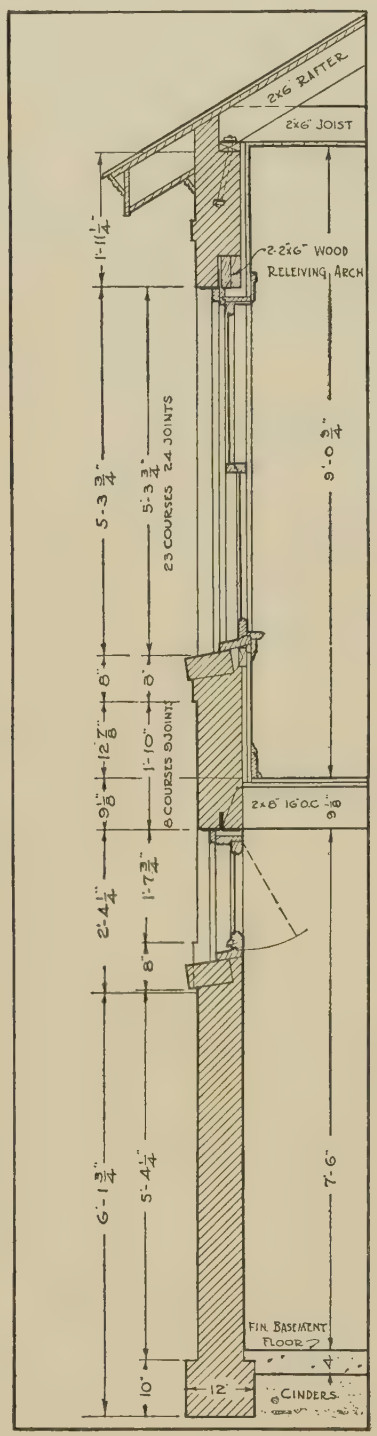
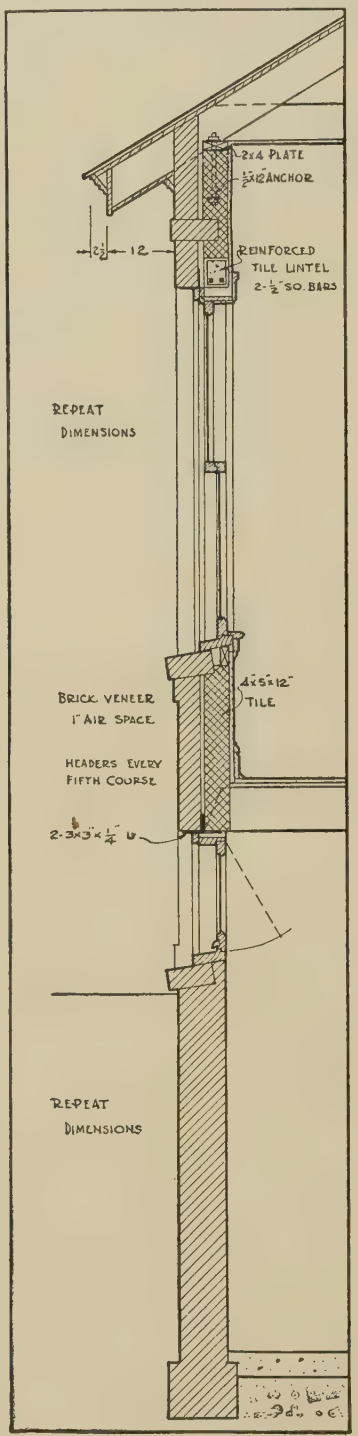

A. BRICK - BUNGALOW
CORNICE
AND
WINDOW - DETAIL
SCALE 3"=1'-0"
FRONT - ELEVATION
SCALE 1/4"=1'-0"
FACE BRICK
SHINGLE ROOF
12"

PLATE 45

TYPICAL WALL SECTIONS

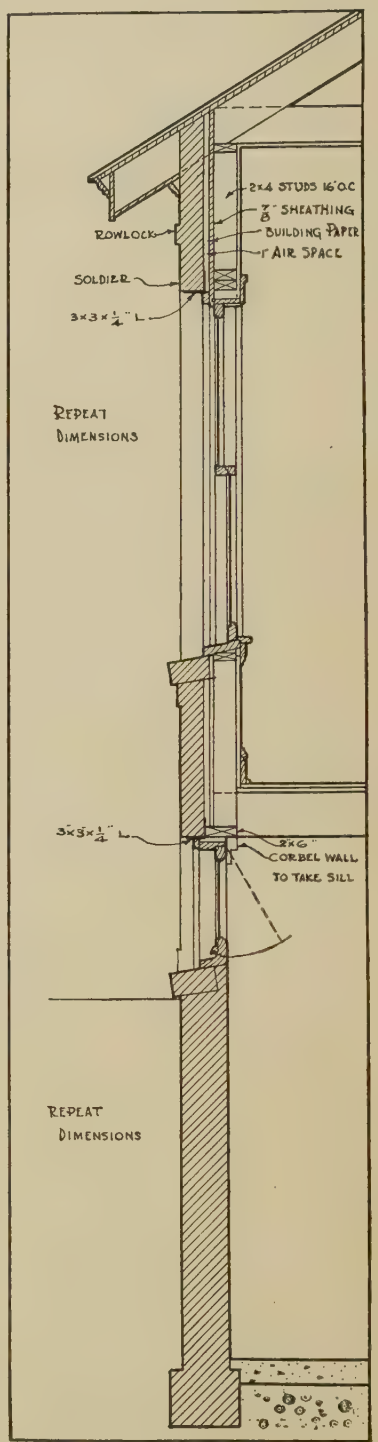


SOLID BRICK CONST



BRICK VENEER ON TILE

SCALE 3/4"=1'-0"



BRICK VENEER ON FRAME

PLATE 46

PROBLEM 25—BRICK GAS FILLING STATION

Gasoline filling stations are becoming so numerous, that they present one of the most common problems for the designer or builder. They are usually of masonry construction, attractively designed and carefully located. They must be easily seen and must also be readily accessible from the street. There are two types: one a small office independent of the pumps, and the second type with the pumps sheltered by a projecting pergola porch. The former is illustrated in the accompanying perspective. The office usually contains a work room, closet and toilet space. In larger stations a ladies' rest room and toilet is provided. The positions of the pumps, drive ways and storage tanks are not considered in this problem. These factors will vary according to the site and the amount of space available. The station illustrated offers the student a splendid problem in brick construction. The use of face or tapestry brick with stone trim and a Spanish tile roof makes a pleasing combination. The wide overhang of the roof affords much protection for the entrance.

Given: Perspective and plan sketch.

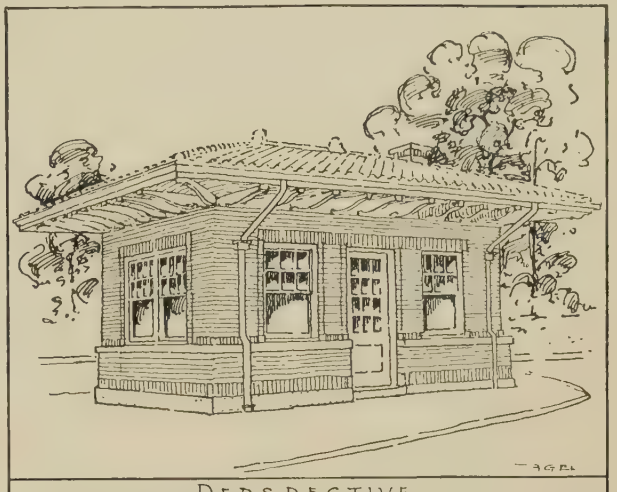
Required:

(1) Floor plan at ½″ scale.

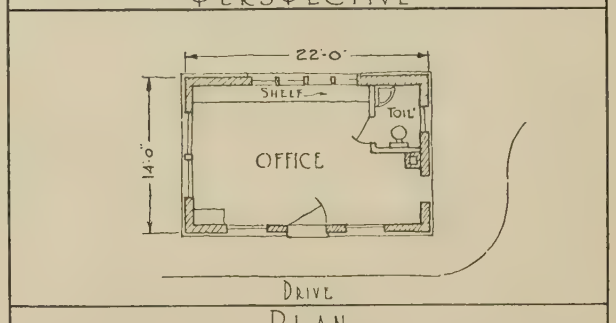
(2) Four elevations at ½″ scale.

(3) Typical wall section at 1½″ to the foot, showing vertical window section. (Prob. 24, and Plate 46.)

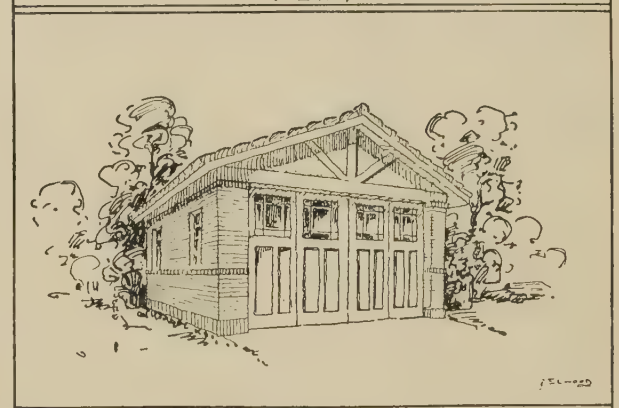
If desired, a Flemish bond for a 9″ brick wall may be used. (Art. 60 and Fig. 38.) A large scale elevation of the building should then be drawn to illustrate the bonding.



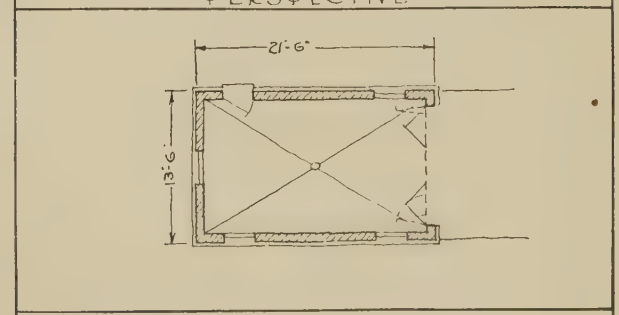
PERSPECTIVE



PLAN



PERSPECTIVE



PLAN

PROBLEM 26—BRICK GARAGE

A brick garage offers a simple and practical problem in masonry construction.

A 9″ brick wall is used with a 10″ concrete foundation extending 4′ 0″ below grade. Make the concrete floor 5″ thick and pitch toward a center drain. Openings should be spaced according to brick sizes and mortar joints as previously directed. The design shows stucco and half-timber gables with

Spanish tile roof. To carry the brick over door and window openings, steel angles must be used. For an opening up to 4′ 0″ use a 4″x3″ or a 3″x3″x¼″ angle. Up to 5′ 0″ a 3″x5″x¼″ angle and for a larger opening a heavier section is required. Lintels or angles should be 8″ longer than masonry opening.

Given: Perspective and plan sketch.
Required:
(1) Floor plan at ½″ scale.
(2) Four elevations.
(3) Typical wall section at large scale.

English or Flemish bonds may be employed.

Reference Books

A. Architectural Design.

1. *Architectural Design,* by John Beverly Robinson. D. Van Nostrand Company, 8 Warren Street, New York City.
2. *House Beautiful* (Magazine).
3. The White Pine Series of Architectural Monographs.
4. *Building Age and the Builder's Journal* (Magazine).
5. *The National Builder* (Magazine).

B. Construction.

1. *Building Construction and Superintendence,* by F. E. Kidder.
   a. Part 1. *Masonry*
   b. Part 2. *Carpentry*
   c. Part 3. *Trussed Roofs*

   } The Wm. Comstock Co., New York.
2. *Carpentry and Contracting.* Five Volumes. American Technical Society, Chicago, Ill.
3. *Carpentry,* by Ira S. Griffeth. Manual Arts Press, Peoria, Ill.
4. *Problems in Carpentry,* by E. M. Roehl. Webb Publishing Co., St. Paul, Minn.
5. *Good Practice in Building Construction,* by Philip G. Knobloch. Pencil Points Press, New York.
6. *Frame Construction Details.* National Lumber Manufacturers' Association, Chicago, Ill.
7. *Building Details,* by Frank M. Snyder. Frank M. Snyder, New York.
8. Architectural and Building Magazines.
9. *The Architect's and Builder's Pocket Book,* by F. E. Kidder. John Wiley & Sons, New York.
10. *Handbook of Building Construction.* Two Volumes. Hool and Johnson, McGraw-Hill Book Company, New York.
11. *Cambria Steel.* Cambria Steel Company, Philadelphia, Pa.
12. *Carnegie Steel Company's Pocket Companion.* Carnegie Steel Co., Pittsburgh, Pa.
13. *Atlas Handbook on Concrete Construction.* The Atlas Portland Cement Company, Chicago, Ill.
14. *Southern Pine Manual.* Southern Pine Association, New Orleans, La.
15. *Sweet's Catalog.* Sweet's Catalog Service, Inc., New York.
16. *Contractor's and Builder's Handbook,* by William Arthur. David Williams Company, New York.

C. Drawing (Architectural).

1. *Architectural Drawing,* by Wooster Bard Field. McGraw-Hill Book Company, New York.
2. *Progressive Steps in Architectural Drawing,* by George W. Seamem. Manual Arts Press, Peoria, Ill.
3. *Architectural Drafting,* by Howe and Greenburg. John Wiley & Sons, New York.
4. *Engineering Drawing,* by French. McGraw-Hill Book Company, New York.
5. *Architectural Drafting,* by Industrial Correspondence University, Philadelphia, Pa.
6. *Architectural Drawing and Lettering,* by Bourne, Von Holst and Brown. American Technical Society, Chicago, Ill.

D. History of Architecture.

1. *History of Architecture,* by B. Fletcher. Charles Scribner's Sons, New York.
2. *History of Architecture,* by Russell Sturgis. The Baker and Taylor Company, New York.
3. *History of Architecture,* by Hamlin. Longmans, Green & Co.

E. Small House Design and Plan Books.

1. The Architects' Small House Service Bureau of the U. S., Inc. Books by various divisions: Northwestern Division, Mountain Division, etc.
2. *Dalzell's Homes of Moderate Size,* by Hammel. U. P. C. Book Co., New York.
3. *Distinctive Homes of Moderate Cost,* by Saylor. R. M. McBride & Company, New York.
4. *Bungalows,* by Saylor. R. M. McBride & Co., New York.
5. *Successful Houses and How to Build Them,* by White. The MacMillan Company, New York.
6. *The House; Its Plan and Decoration and Care,* by Isabel Bevier. School of Home Economics, Chicago, Ill.
7. *Building Age and the Builder's Journal.*
8. *The National Builder.*
9. *House Beautiful.*
10. *Competition Plans,* by White Pine Bureau, St. Paul, Minn.

F. Lettering.

1. *The Essentials of Lettering,* by French and Meiklejohn. McGraw-Hill Book Co., New York.
2. *Letters and Lettering,* by Frank C. Brown.

G. Order of Architecture.

1. *Vignola,* by Pierre Esquie. French Edition. Bates & Guild Company, Boston.
2. *Vignola,* by Arthur L. Tuckerman. Wm. T. Comstock Co., New York.

H. Miscellaneous.

1. *Principals and Practice of Plumbing,* by J. J. Cosgrove. Standard Sanitary Manufacturing Co., Pittsburgh, Pa.
2. *Freehand and Perspective Drawing,* by Everett and Lawrence. American Technical Society, Chicago, Ill.
3. *Shades and Shadows,* by David C. Lange. John Wiley & Sons, New York.
4. *Shades and Shadows,* by McGoodwin. Bates and Guild Co., Boston, Mass.
5. *Architectural Rendering in Wash,* by McGonigle. Charles Scribner's Sons, New York.
6. *Pen Drawing,* by Maginnis. Bates and Guild Co., Boston, Mass.
7. *Pencil Drawing,* by Arthur Gupthill. The Pencil Points Press, New York.
8. *Architectural Interior and Exterior Woodwork,* by the Curtis Companies, Clinton, Iowa.
9. *The Standard Moulding Book,* by Southern Pine Association, New Orleans, La.
10. *Garden Making,* by L. H. Bailey. The MacMillan Co., New York.

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